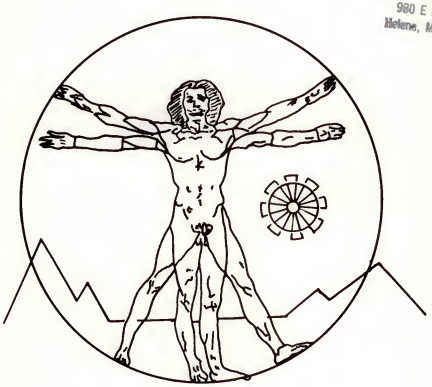
MONTANA AIR POLLUTION STUDY
1977 - 1979

INITIAL TASK PLANNING
November 1977



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INITIAL TASK PLANNING FOR MONTANA AIR POLLUTION STUDY (MAPS)

FINAL REPORT

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SECTION I

INTRODUCTION

This report presents the results of an initial planning contract designed to undertake the task planning and cost estimating efforts involved in the early stages of the Montana Air Pollution Study (MAPS), a study of air pollution and health in various areas.

The MAPS program was initiated by the Air Quality Bureau of the Environmental Sciences Division in the Department of Health and Environmental Sciences (DHES), in response to the passage of House Bill 250 by the 45th Montana Legislature. The Air Quality Bureau staff, with the assistance of advisors both within and outside of the DHES, developed a proposal project plan which was then reviewed in both administrative and public forums.

The function of the contractual effort reported herein was to extend project planning from this conceptual plan into the initial stages of an operational study effort. This involved organizing the proposed work effort into specific tasks, developing cost estimates for the various tasks, with alternative approaches where possible, assisting in the prioritization of the tasks into a study scope commensurate with the budgetary appropriation, and the development of draft scopes of work and other procurement documents relating to the high priority tasks requiring early initiation.

The time schedule involved in conducting a study of the magnitude of MAPS within a single biennium is necessarily very tight. Consequently, the GCA personnel involved in this initial contract have worked very closely with

the Air Quality Bureau staff and their Advisory Committees in order to minimize the time lost in iteratively arriving at conclusions. The definition of tasks and their prioritization within the budget is essentially a common effort among the staff, the Advisory Committees, and the authors of this report; the specific task order documents, organizational suggestions, and similar recommendations are based on the knowledge and understanding the authors have developed concerning MAPS, but they have not yet been thoroughly reviewed and approved by the Bureau staff.

Because of the close collaboration in developing these priorities and recommendations, and in the interest of the time schedule, this document is not designed to be a thorough report to the Air Quality Bureau concerning the details of the joint effort; rather, it is intended to document for the public record the major features of the project development effort to date and the overall approach to the basic purpose of the MAPS study.

Section II of this document presents an overview of the underlying conceptual approaches involved in the assessment of possible air pollution effects on health. Section III is a discussion of the task planning and prioritizing efforts undertaken, and the results obtained, and Section IV is a brief review of the suggested division of management roles and responsibilities. Section V presents the suggested contractual structure and the draft procurement documents for the major initial tasks. Section VI includes, primarily for reference, the detailed task description used for estimating costs.

SECTION II

HEALTH EFFECTS STUDY RATIONALE

This section presents a brief overview of the approach utilized by the MAPS project in examining the relationship between health effects and air pollution. It is presented here as a matter of public record, since this technical area was not thoroughly defined at the time the initial proposed project plan was prepared.

House Bill 250 calls for an air monitoring and health study in several Montana cities. The MAPS program addresses this requirement by utilizing several approaches to identify and quantify the health effects, if any, of air pollutants; by monitoring the amounts of health-related pollutants and the meteorological parameters that affect the pollution exposure of the population; and by providing a comprehensive system for the evaluation of the air pollution impact of future growth and development on the health of Montana residents. The purpose of this section is to outline the several approaches being utilized to identify and quantify the health efforts attributable to air pollution.

One basic approach being undertaken in a number of the study cities is detailed examination of death certificates over a several-year period. A preliminary examination of aggregate mortality data has indicated abnormally high death rates in several Montana counties for several causes of death commonly associated with air pollution (specifically, cancer of the lungs, emphysema, and chronic bronchitis). In fact, the concern evidenced over these findings was part of the evidence on which the legislature based the need for the present study. Under the MAPS program, the DHES

will conduct a thorough death certificate follow-up study based on interviews with survivors and data from clinical records of persons dying of these selectec causes. The data acquired through this study will permit assessment of the death rate data as a function of period of residence, smoking habits, and similar factors necessary to evaluate the likely influence of environmental factors.

The intrinsic limitations on the information to be gained from mortality studies requires that they be complemented by assessments of morbidity, that is, illness or other health difficulties short of severe illness and death. These possible effects are more readily identified as being caused or not caused by environmental factors, such as air pollution, because it is possible to relate them to measured values of the air pollution or other factors. However, because the morbidity effects are less severe and occur over a shorter period than the long-term mortality effects, it is necessary to carefully look for them with studies specifically designed to identify the type of effects typically associated with air pollution exposure.

The MAPS program is initially undertaking three major types of morbidity effects studies. The simplest of the three are studies of existing data on hospitalizations and physician visits in conjunction with existing data on air pollution and meteorology. These studies are relatively insensitive, that is, they are likely to identify only quite severe air pollution health effects. However, because they use existing data, they are relatively inexpensive, and their cost-effectiveness is high.

The other two major types of morbidity studies are both based on measurement of pulmonary function parameters on human subjects. Pulmonary function measurements are simple, painless tests based on the subjects' blowing into an apparatus, but they are capable of providing very objective information on the physiological capabilities of the subjects' lungs.

Two totally different groups of study subjects will be involved in pulmonary function studies under MAPS. One type of study utilizes a group of adult patients known to be suffering from chronic obstruction pulmonary disease (COPD), a category that includes asthma, emphysema, and chronic bronchitis. If air pollution at the levels experienced in Montana cities causes respiratory insult, it is expected that these members of the population would be among the most sensitive, and would be expected to exhibit noticeable deterioration in lung function during periods of higher air pollution exposure. Because of the possibility of directly relating short-term changes in measured levels of air pollutants and measured values of pulmonary function, the COPD patient studies have the best potential for quantifying air pollution health effects and for identifying the particular air pollutant substance or substances responsible. However, the COPD patient studies must necessarily rely heavily on the cooperation of a sizable number of adult volunteers over a period of at least a year, a degree of volunteer effort that is not always easy to obtain. Consequently, the COPD patient study is being pilot tested in Missoula County, where a known high level of environmental concern is expected to provide the best chance for success. If it proves possible to develop an adequate degree of cooperation in Missoula, similar studies will be conducted elsewhere.

The other major type of pulmonary function study involves the use of a study group made up of elementary school pupils. This type of study has been and is currently being used by the Federal Public Health Service and the Environmental Protection Agency to evaluate air pollution health effects in other areas of the country, so that obvious comparisons are possible with school children studies in Montana. The reasons for selecting young school children for study are twofold; first, they are not affected by the extraneous influences of smoking and occupational exposures, and second, they provide a significantly large study population that is available for testing as a group in one location, without the significantly greater time (and hence cost) of seeking out and testing

individual adults. National studies have indicated that children raised in areas with significantly different environmental conditions do show measurable differences in pulmonary function values. It is not of course clearly known how well such a study may work in defining air pollution health effects in Montana; however, it is considered by national air pollution and health authorities to be the most appropriate epidemiological tools for studying such effects, and so has been incorporated. It will also be pilot tested in Missoula and, if it proves appropriate, later extended to the other cities.

SECTION III

TASK PLANNING AND PRIORITIZATION

This section describes briefly the manner in which the various possible efforts under MAPS were organized into tasks, and subsequently prioritized within the budgetary appropriation.

The conceptual plan for the MAPS project was initially developed by the Air Quality Bureau staff and compiled in a draft document dated May 1977. The next major steps in the project planning process were to develop adequately-detailed cost estimates for the various components of the conceptual plan, compare these to the available funding and, if necessary, prioritize the project components with respect to their importance in the context of the appropriation.

The contract efforts documented herein began with the division of the proposed study efforts into specific, well-defined work tasks. GCA staff became familiar with the physical settings and air quality of the MAPS study cities, and with the conceptual objectives of the proposed MAPS program. Through interviews with Air Quality Bureau staff members, other potential resource people and firms, and through the meetings of the various advisory committees, a list of possible approaches or suggested components to the various portions of the study was assembled. Where possible, a variety of options was included, although suggested options that were clearly not feasible were discarded. In this fashion, a list of tasks was defined that could be fairly accurately costed. This task list was categorized in six technical areas corresponding to the several project areas identified in the original conceptual plan, and

brief task descriptions and cost estimates were prepared; these are presented in Section VI for reference.

The total of the cost estimates was such (see Section VI) that if every suggested task were undertaken to its maximum extent, the overall project cost would exceed the appropriation by nearly a factor of three. Consequently, as expected, an effort to define priorities among the tasks was required. Priorities were required in each technical area, reflecting the relative importance of the various tasks in meeting the objectives in that area, and priorities were also required among all the higher priority tasks together, reflecting the relative importance of the various technical areas in meeting the overall objectives of the entire MAPS project.

Because the costs were such that a severe reduction in the task list was necessary, a careful, thorough, somewhat formalized system was utilized by the Air Quality Bureau in the prioritization process. The prioritization system, developed by researchers in communications and group dynamics, is essentially a structural methodology for developing a consensus within a small group; the step-by-step procedure is presented in Table 1.

The prioritization procedure was utilized first within each technical work area; the lists of tasks in Section VI were expanded slightly to bring the various options under each task more explicitly into the prioritization, and the procedure was then undertaken on each of the areas A through F. The prioritization was done separately by the relevant advisory committee and by the Bureau staff; in each area, there were no significant differences between the two resultant lists, and this was interpreted as indicating a rather clear-cut technical consensus.

The prioritization procedure was then utilized to prioritize the overall list of tasks from all the technical areas combined. This proved to be somewhat more difficult, because the judgments to be made typically

Table 1. PROCEDURE FOR ESTABLISHING PRIORITIES

OVERVIEW: Prioritization occurs in three steps:

1. Address the top 4 items.
2. Address the bottom 4 items.
3. Address the middle set of items.

Addressing the top set forces a definition of what is important; addressing the bottom set forces a decision about what can be traded off; and addressing the middle set defines the limits of the top and bottom sets.

A. Initial Procedure.

1. Discuss each item to be prioritized to be sure of common understandings.
2. Discuss the implications of prioritizing. What will happen because an item is labeled a top priority versus a low priority?

B. Procedure for top set.

1. Each individual lists the 4 he thinks should be in top set.
2. Tally the scores for all items listed on a board.
3. Assumption: The item with the largest tally is the highest priority.
4. Question: Do all agree that largest tally is top priority?
5. Discuss the implications of making the ranking of the top 4 priorities.
6. Rearrange order to suit group agreement.
7. Force a limit to the top 4 items.
8. Force a ranking of the top 4 items.

C. Procedure for bottom set.

1. Follow the pattern in III, but the list of items eligible for consideration excludes the top 4 items already ranked.
2. Assumption: The item with highest tally is the lowest priority.
3. Question: Do all agree that lowest tally could be a trade off?
4. Discuss implications and settle on a final ranking.

D. Procedure for middle set.

1. Follow the pattern in III, but the list of items eligible for consideration excludes the top 4 items and the bottom 4 items already ranked.
2. Look at the first ranked item in the middle set in terms of the last ranked in the top set. Satisfied or should they be rearranged?
3. Look at the last ranked item in the middle set in terms of the first ranked item in the bottom set. Satisfied or should they be rearranged?

E. Prioritization completed.

involved comparisons of unlike items; consequently, the formalized structure was particularly helpful. This combined prioritization was begun with a list of the highest priority items from each separate list (roughly one-third from each), and then the lower priority set from this combined list was specifically compared with the remaining items, etc. In the process of performing this prioritization, two additional factors were brought into consideration. Recognizing that most items have some time priority as well as an importance priority, specific attention was paid to defining the priority status of those tasks that require early action or an early decision. Beyond this, an additional effort was made to assure that the resultant list of tasks was internally consistent and not "piece-meal;" that is, that the technical efforts addressed were completely and consistently addressed, rather than incorporating a possibly larger number of different approaches, some of which might be inadequately addressed. Primarily, this latter concern resulted in increasing the priority given to a few small tasks that serve primarily to complement and round out some of the major thrusts of the program.

The resultant combined priority list is presented in Tables 2 and 3. It has been condensed for clarity by combining many of the individual tasks into more coherent groupings; the combined letter-numeral task designations refer to the descriptions in Section VI. The combined priority list has been grouped into three major groupings, as described in the tables. The first group is essential and needs to be implemented relatively shortly. The second group is similarly important, but can be deferred somewhat in time; this permits a possible reassessment after the actual costs of some of the PRIORITY I group have been defined by actual procurement. The first two groups of tasks together are those that can reasonably be attempted within the budget, based on the following cost summary:

Table 2. PRIORITY GROUPING OF TASKS (I AND II)

PRIORITY I. These tasks are essential to the basic core of the MAPS project, and most also require immediate implementation.

- Pulmonary function studies and associated support efforts (tasks A8-10, D14, E2)
- Carcinogen/mutagen screening study (task A12)
- Morbidity data studies (tasks A4, A6-7, E1)
- Mortality studies in secondary MAPS cities (tasks A1-2)
- Areawide total and respirable particulate monitoring, with associated analyses (tasks B1, B8-10)
- Continuous gaseous pollutant monitoring (task B3)
- Meteorological support monitoring in Missoula and Billings (tasks C3-6, C11-12)
- Basic design of data management system and standards and effects subsystem (tasks F1(5), F2(3), F6(2))

PRIORITY II. These tasks are required for the completion of the overall MAPS program objectives, although less fundamental or of less urgency than Priority I. On reevaluation, specific tasks may be interchanged between Priorities II and III.

- Initial development in support of episode prevention system (tasks C10, F5)
- Emission inventory update and improvement (tasks D1, D4, D8, D9(a), 10(a))
- Meteorological support monitoring in Butte and Anaconda (tasks C1, C14)
- Basic design and development of emission inventory and meteorological modeling systems (tasks D6, F3(4), F4, F8)
- Historical emission inventory - initial feasibility exploration (task D11(a))
- Additional monitoring equipment for SO_2 and for special studies (tasks B2, B12)

Table 3. PRIORITY GROUPING OF TASKS (III)

PRIORITY III. These tasks are considered desirable, and supportive of MAPS program objectives, but must be held in abeyance pending the outcome of procurements for other tasks in Priority I or II.

- Additional data studies of mortality in Billings and Missoula, and of physician visits in Billings (tasks A3, A5)
- Alternative carcinogen/mutagen screening programs (tasks A13-15)
- Additional monitoring equipment for special indoor/outdoor studies (tasks B13)
- Special sulfate characterization study (task B11)
- Additional meteorological support monitoring (tasks C2, C7-8, C9, C13, C16, C17, C18)
- Further emission inventory development (tasks D2-3, D5, D7, D12)
- Special emission factor development work (tasks D9(b), D10(b-c), D13)
- Further historical emission inventory (tasks D11(b-c))
- Extended data systems and modeling capability (tasks F1(6), F2(4), F6(3)-(4), F7)

	Cost ($1000s)
Priority I tasks	605
Priority II tasks	222
Statistics, data analysis	70
Management, consultants	100
	997

The PRIORITY III tasks are those that must, as a matter of budgetary necessity, be reserved for subsequent implementation if subsequent re-assessments indicate that funding permits. It should be noted, however, that periodic reassessments will also be necessary on technical issues, so that some minor rearrangements between the latter two priority groups is possible.

SECTION IV

SUGGESTED MANAGEMENT STRUCTURE

This section outlines the managment structure GCA suggests for MAPS; it is similar to the approach presented in the May 1977 proposed MAPS project plan. Through the "matrix management" concept, it is designed to provide for the close coordination of MAPS activities, among themselves and with other AQB programs, while minimizing any interference with the normal functioning of Bureau activities.

The basis of the MAPS management structure is a management TEAM which will serve to coordinate MAPS efforts within, yet independent of, the existing AQB organization. The TEAM should serve as an overall coordinating group, with the Air Quality Bureau Chief maintaining overall responsibility as General Project Manager, and a Technical Manager and Project Coordinator from outside the AQB staff serving to carry the bulk of the additional management workload.

The management TEAM structure should be comprised of the following specific roles or functions:

- General project manager
- Project officers in six work areas
  - Mortality Studies
  - Morbidity Studies
  - Air Quality Monitoring
  - Meteorological Monitoring
  - Emission Inventory
  - Statistics and Data Analysis
- Technical manager
- Project coordinator

- Finance officer
- Consultants and contractors

The following brief discussion outlines the suggested scope of each role or function and their interactions.

General Project Manager - The Chief of the Air Quality Bureau, as General Project Manager, should maintain overall responsibility for all aspects of the MAPS project, both technical and financial. He should direct MAPS affairs through the management TEAM as a group, and make specific arrangements and assignments of detailed responsibility as appropriate. The general manager should maintain final authority for authorization of any activity involving the expenditure of State funds, including the authorization of travel, the hiring of personnel for MAPS, and the selection of contractors, based on the collective recommendations and advice of the management TEAM.

Project Officers - The project officers in the six major technical areas of MAPS should, together with the technical manager, provide detailed technical direction for MAPS. The project officers and technical manager should function as a group in formulating and recommending to the general project manager various decisions or courses of action, as well as in carrying out agreed-upon decisions and policies. In particular, the project officers should perform the following functions within the group with respect to the technical area they oversee:

- Represent to the technical manager, to the TEAM, and to the general project manager the viewpoint and interests of their respective technical areas in all decisions or other matters of concern respecting MAPS.
- Assist in the recruitment and supervision of individual employees and contractors involved in work in their technical area, by recruiting and interviewing individuals, by reviewing technical proposals and recommending acceptable contractors, and by overseeing work in progress and reviewing results.

Technical Manager - The technical manager should function as the leader of the TEAM and the primary focus for technical coordination of MAPS, cooperating with the project officers in overseeing the several technical project areas and assuring the project manager of an integrated, balanced technical effort. Specifically, the technical manager should:

- Prepare technical work statements covering specific tasks for the review of the project officers and project manager.
- Provide technical advice and assistance to the project officers, and assessments and recommendations to the general project manager, in the areas of technical approach, contractor selection and evaluation, priority judgments, and the evaluation and interpretation of project results. Final decision authority must remain with the general project manager, based on recommendations on alternative courses presented to him by the TEAM as a group; the technical manager should assure that all relevant viewpoints are in fact developed and presented.
- Work with the MAPS project coordinator in developing and maintaining a reliable system of project scheduling and performance tracking, and in coordinating communications, meetings, etc., among the TEAM members.
- Cooperate with the MAPS finance officer in maintaining an up-to-date and accurate picture of the status of MAPS project funds and in overseeing the fiscal relationships with contractors.

Project Coordinator - The project coordinator should be the primary administrative aide to the general project manager and the TEAM, and the primary liaison between them and the finance officer in matters involving MAPS. The project coordinator should:

- Serve as the primary focus of written communications among the technical manager, the project officers, and the various consultants and contractors, maintaining files of record for the project and assuring the proper distribution of official materials.

- Maintain surveillance over the timeliness of contractor performance, and assist the technical manager and project officers in maintaining surveillance over the technical adequacy of contractor efforts.
- Serve as liaison with various sources of nontechnical support, in matters such as services procurement, and with the MAPS finance officer in fiscal matters.

Finance Officer - The finance officer should be the interface between the MAPS management TEAM and the State budget and fiscal system. He should guide and direct the TEAM members in complying with appropriate fiscal policies and procedures, and assist them as required with the financial and fiscal aspects of maintaining surveillance over the performance of contractors and individuals.

Consultants and Contractors - The activities and roles of the various individuals and firms participating contractually in the MAPS projects will, of course, be defined primarily by the terms of their specific contracts. Unless provided otherwise, their primary technical liaison should be with the relevant project officer and through him with the technical manager. The primary fiscal contact should be with the project coordinator and through him with the finance officer. Submission of official materials such as monthly reports should be made through the project coordinator.

SECTION V

TASK STRUCTURE AND PROCUREMENT DOCUMENTS

This section presents the suggested structure designed to interface MAPS tasks with the fiscal and procurement systems of the state and the Department, and presents draft scopes of work for the initial task procurements.

TASK NUMBERING STRUCTURE

The fiscal system of the state provides for all procurements, ranging from equipment purchases to the personal services of consultants, to be systematized with an Encumbrance Estimate number, which is in turn charged against a budget number. It is suggested that the MAPS program utilize the budget numbering system to organize both tasks within the various technical areas of MAPS and specific contracts or procurements within the individual tasks. The specific number system suggested has been developed in conjunction with the MAPS fiscal officer; it combines the MAPS budget number (0638) with a two-digit task number (0638-XX) and, if appropriate, a contract number within tasks (0638-XX-YY). In this framework, each component of the number serves a specific role in maintaining fiscal controls. The 0638 budget code serves to distinguish MAPS from other Air Quality Bureau projects. The task number XX will be the primary mechanism for fiscal control within MAPS, serving to assist planning by providing the project officers and the technical manager with the means for comparing task-level expenditures with advance estimates of task costs. The contract number YY within each task will serve two purposes; in cases of significant-sized contracts with a specific firm or individual, it will serve as the key to fiscal summaries for monitoring performance under that contract, and, in conjunction with the Encumbrance Estimate number, serve

as the interface between the technical staff and the MAPS fiscal officer and the means for relating contract obligations and the state disbursement system. Table 4 outlines the system of task numbers designed by the MAPS fiscal officer, based on the five major technical areas.

TASK STATUS MONITORING SYSTEM

In order to help maintain careful monitoring of the individual tasks (or individual contracts within tasks), during task development, it is suggested that a specific list of various status categories be defined, and the change of any task from one category to the next be made a specific administrative action subject to appropriate discussions and approvals. The following list of categories is suggested.

Category

1. Task defined; i.e., identified and labeled
2. Task selected for implementation
3. Scope of work defined; i.e., agreement on technical content
4. Task number assigned by fiscal officer
5. Procurement selected (agreed on source and/or method of procurement)
6. Agreement on draft RFP, contract, or job description
7. Selection of contractor, employee
8. Contract number(s) assigned by fiscal officer
9. Completion of contract; work initiation
10. Task closed

Note that categories 7 through 10 are applicable to individual contracts in the case of multiple-contract tasks, rather than to the entire task

Table 4. TASK BUDGET NUMBERING SYSTEM

Task number	
0638 - 01	Health effects - general administration
0638 - 02-19	(Reserved for health effects tasks)
0638 - 20	Air monitoring - general administration
0638 - 21-38	(Reserved for air monitoring tasks)
0638 - 39	Emission inventory - general administration
0638 - 40-57	(Reserved for emission inventory tasks)
0638 - 58	Meteorology/modeling - general administration
0638 - 59-76	(Reserved for meteorology/modeling tasks)
0638 - 77	Statistical analysis - general administration
0638 - 78-95	(Reserved for statistical analysis tasks)
0638 - 96-98	(Reserved)
0638 - 99	General MAPS administration

as a whole. Note also that these categories provide primarily for the contractual/administrative process of task development, the portion of the overall process where coordination and consultation among the various technical areas is most required. The technical monitoring of the progress of each task, (i.e., while the task in Category 9), is a matter which must be dealt with differently for different types of procurements.

It is suggested that a formal system be adopted for documenting the change of any task from one category to another. The goal of such a system should be to assure that there are no task changes from one status to another without consultation and concurrence by all affected personnel or, in lieu of concurrence, by project manager's resolutions of differences. The following suggested approach is based on a system of "Status Change Memos," and is meant to minimize the effort spent in maintaining the system per se, while assuring an appropriate record.

Step

1. Project officer in charge of the task under consideration prepares a draft memo describing the planned status change in whatever detail is appropriate to the size of the task and the significance of the change. Alternatively, project officers can request project coordinator by phone or note to initiate a routine change memo.

2. The project officer for each of the other technical areas must either initial his concurrence or briefly note on the memo his reasons for disagreement. (This step will take very little time if the proposed action has been properly discussed with the affected project officers in advance, as it should be.) When some of the technical areas are not impacted by the task in question, those project officers need not be consulted, but the project coordinator or technical manager should concur with the lack of impact. (For example changes from status 3 to 4 involve only the fiscal officer and the project officer, and other concurrences are not needed.)

3. The project general manager will concur with the status change, return it for changes, or raise the matter of disagreements for discussion, as is appropriate in each case.

4. When a status change memo is approved, the project coordinator will provide a sequential memo number (see next section), distribute the change memo, and make the appropriate changes in the overall project schedule.

SEQUENTIAL MEMO SYSTEM

This section suggests a formal system of sequentially-numbered memos to include not only the status change memos described above, but also other documentation as well. This central memo system is meant to serve both as a channel for communication and approvals and as a formal public record for the entire project. The memos should be routinely distributed to a complete list of recipients by a single source (presumably the project coordinator) and be consecutively numbered so that a complete set can be easily maintained.

Several totally different types of memos should go into the series:

- Status change memos described previously
- General reference material (e.g., advisory committee addresses, etc.)
- Periodic summaries of task status
- Periodic budget summaries
- Agendas/minutes of MAPS staff meetings

Depending on the nature of the memo and the circumstances, memos can be prepared and initiated by anyone, but they must all be processed through one source in order to maintain the benefits of uniform distribution and sequential numbering.

As examples, the following could reasonably be the first series of memos to start the system off.

1. Description of system and recipient list
2. General approval policies for MAPS
3. List of potential sources responding
4. Advisory committee names, addresses, phones
5.- 10. Task status in each technical area as of a specific initiation date
11. Overall budget and task status summary on initiation date

HEALTH EFFECTS TASKS

The pulmonary function testing is one of the major initial priorities for implementation because of the required lead time for advance preparation, hiring and training, and the requirement to meet school system schedules. The following tasks should be implemented immediately:

- Pulmonary function quality assurance
- Pulmonary function studies - general
- Pulmonary function studies - Missoula

In order to provide for a proper quality assurance atmosphere and help guarantee both the fact and appearance of objective, high-quality pulmonary function data, it is suggested that this function be handled by a committee of consultants independent of the MAPS and AQB staff. There are a number of persons in the various MAPS cities with pulmonary function and public health expertise, and this resource should be utilized. Draft scopes of work for the chairman and members of such a committee follow this section. It is suggested that the committee be organized and chaired by Dr. R. Buswell of Helena, as a respiratory physician in a city not otherwise associated with MAPS; a suggested list of committee members, drawn from the various MAPS cities, is included in the draft scopes of work.

The general initial development of the pulmonary studies should also be initiated immediately in order to ensure an adequate start on the pilot effort during the 1977-1978 winter. Draft scopes of work for this task and for the provision of the morbidity studies project officer also follow this section.

The initial implementation of the pilot study in Missoula should also begin immediately. Recruiting, planning, and similar functions are provided for under other tasks. Draft scopes of work are provided for the roles of pulmonary technician and scheduler/manager.

The remainder of the health effects tasks should be initiated at an early stage in order to assure an early appraisal of the effectiveness of the overall study plan. The St. Patrick's Hospital data update should be initiated by an informal request for a sole source proposal from the University of Montana's Environmental Studies Program. The physician visit data studies should be initiated by data-acquisition contracts with the Western Montana Clinic and the Montana Foundation for Medical Care; draft descriptions for these contracts have not been included, as they need to be developed in detail between the data sources and the morbidity area project officer. Similarly, draft documents for the death certificate studies have not been included pending review of the existing three-county program.

DRAFT SCOPE OF WORK 0638-03-01

CHAIRMAN, PULMONARY FUNCTION QUALITY ASSURANCE COMMITTEE

DESCRIPTION OF SERVICES

The parties agree that the following services shall be performed by the First Party on behalf of the Air Quality Bureau:

Acting as chairman of a committee of consultants to the MAPS program, the First Party shall coordinate and participate in the development, review, revision, and presentation to the Bureau of a pulmonary function testing protocol and an ongoing quality assurance program for use in the pulmonary function testing portions of the MAPS program.

Specifically, the testing protocol and quality assurance program shall address the following issues:

(a) Routine procedures to be followed by personnel administering the test, both prior to a period of testing and during the conduct of each test.

(b) Appropriate equipment setup and checkout procedures, and routine calibration checks, to be conducted by testing personnel.

(c) The nature of the appropriate plan, if any, for the periodic checkout or calibration of the spirometry equipment and/or the periodic rotation of equipment or personnel.

(d) The appropriate nature of the checks to be made on the agreement between printed output parameter values and those read from the graph charts produced by the equipment.

(e) Any other issues considered important to the maintenance of consistent, and accurate pulmonary function testing results.

The testing protocol and quality assurance program as developed by the committee should also address the differences in procedure to be followed in the different testing situations currently envisioned under MAPS: the testing of adult patients with chronic obstructive pulmonary disease in home or medical office settings, and the testing of elementary school children in a school setting.

The composition of the consultant committee is as follows:

R. Buswell, Helena, chairman
W. Gemar, Missoula
J. Schaeffer, Billings
E. Shephard, Butte
M. Skinner, Helena

When requested by the committee, the MAPS Project Manager will arrange to have draft materials reviewed, or other consultation provided, by the outside consultants assisting with MAPS.

In the interest of maintaining an appropriate quality assurance atmosphere, it is desired that the committee formulate its technical recommendations in a manner independent of the MAPS project officer for the morbidity study area and other MAPS technical staff; however, communication for information or administrative purposes with the MAPS technical manager or project coordinator is of course appropriate.

The pulmonary function testing equipment to be utilized under MAPS is expected to be_____ or similar, which will be equipped to provide both an analog trace on a chart paper record and printed results on paper tape. It should also be considered by the committee that there may be a portion of the MAPS pulmonary function testing capability based in Helena and available for assignment to various MAPS study cities on a rotating basis.

DRAFT SCOPE OF WORK 0638-03-02 THROUGH 03-05

MEMBER, PULMONARY FUNCTION QUALITY ASSURANCE COMMITTEE

DESCRIPTION OF SERVICES

The parties agree that the following services shall be performed by the First Party on behalf of the Air Quality Bureau:

Acting as a member of a committee of consultants to the MAPS program, the First Party shall coordinate and participate in the development, review, revision, and presentation to the Bureau of a pulmonary function testing protocol and an on-going quality assurance program for use in the pulmonary function testing portions of the MAPS program.

Specifically, the testing protocol and quality assurance program shall address the following issues:

(a) Routine procedures to be followed by personnel administering the test, both prior to a period of testing and during the conduct of each test.

(b) Appropriate equipment setup and checkout procedures, and routine calibration checks, to be conducted by testing personnel.

(c) The nature of the appropriate plan, if any, for the periodic checkout or calibration of the spirometry equipment and/or the periodic rotation of equipment or personnel.

(d) The appropriate nature of the checks to be made on the agreement between printed output parameter values and those read from the graph charts produced by the equipment.

(e) Any other issues considered important to the maintenance of consistent, and accurate pulmonary function testing results.

The testing protocol and quality assurance program as developed by the committee should also address the differences in procedure to be followed in the different testing situations currently envisioned under MAPS: the testing of adult patients with chronic obstructive pulmonary disease in home or medical office settings, and the testing of elementary school children in a school setting.

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DRAFT SCOPE OF WORK 0638-03-01

INITIAL DEVELOPMENT EFFORTS FOR PULMONARY FUNCTION STUDIES

DESCRIPTION OF SERVICES

The parties agree that the following services shall be performed by the First Party on behalf of the Air Quality Bureau:

(a) Prepare draft letters for use in initiating the pulmonary function studies to be conducted under MAPS, specifically:

(i) Draft letters from the DHES Director to physicians and to school authorities, requesting participation in the COPD patient and school children studies, respectively.

(ii) Draft form letters that the physicians and school authorities can be offered for their use in communicating with patients and parents, respectively.

These draft letters should present the background and nature of MAPS in a manner appropriate to the recipient, and should explain the nature of the participation requested in adequate detail.

(b) Prepare drafts of other forms and materials for use in the MAPS pulmonary function studies, specifically:

(i) A patient diary form for use of COPD patients in recording information during their specific period of participation each month.

(ii) A patient history form for recording information prior to the patient study initiation.

(iii) A parent questionnaire for use in obtaining health history and home life information in the school studies.

(c) Investigate the availability in Missoula of required office space and support facilities; specifically, identify and recommend to the MAPS project coordinator rental and other arrangements to provide approximately 500 square feet of office space and associated typing, copying and similar support services.

DRAFT SCOPE OF WORK 0638-09-01

PULMONARY STUDY SCHEDULER-MANAGER

DESCRIPTION OF SERVICES

The First Party, acting in cooperation with the respiratory testing personnel and under the direction of the Morbidity Area Project Officer and the Technical Manager, shall provide scheduling and coordination services with respect to the MAPS pulmonary function studies of COPD patients and elementary school children in Missoula County. Specifically, the First Party shall:

(a) Develop and operate a system for making and scheduling appointments for testing COPD patient subjects in the study office or elsewhere, cooperating with the testing personnel in arranging and maintaining efficient daily and weekly schedules, and in assuring the completion of diaries and questionnaires.

(b) Working with the Project Officer and the testing personnel, coordinate and cooperate in the conduct of the study of elementary school children, including the maintenance of communications with school officials and groups providing volunteer assistance to the study.

(c) Coordinate, oversee, and assist with, the preparation of the pulmonary function testing data in the specified form for entry into the computerized data processing system.

DRAFT SCOPE OF WORK 0638-09-02

PULMONARY TESTING TECHNICIAN

DESCRIPTION OF SERVICES

The First Party, acting in cooperation with the study scheduler/manager, and under the direction of the Morbidity Area Project Officer and the Technical Manager, shall perform pulmonary function testing services for the MAPS pulmonary function studies of COPD patients and elementary school children in Missoula County. Specifically, the First Party shall:

(a) Perform pulmonary function tests, in accordance within prescribed procedures, on COPD patient subjects in the study office or at locations appointed by the patients, and on school children in their schools, cooperating with the scheduler/manager in maintaining efficient daily and weekly schedules.

(b) Process the testing results, and other data obtained via patient diaries and questionnaires, into the form specified for input into the co,puterized data processing system.

DRAFT SCOPE OF WORK 0638-99-xx

CONSULTANT TO SERVE AS MORBIDITY AREA PROJECT OFFICER

DESCRIPTION OF SERVICES

The parties agree that the following services shall be performed by the First Party on behalf of the Air Quality Bureau:

Acting as a consultant to the Air Quality Bureau concerning the Montana Air Pollution Study (MAPS), make recommendations, cooperate, and assist in the development of the Health Effects portion of the MAPS study; specifically, act as a liaison between the Air Quality Bureau and interested parties from the medical profession and other groups as may be requested, develop and submit to the Air Quality Bureau suggestions and proposals concerning the Health Effects portion of the MAPS study.

Following the development and completion of the MAPS project plan and the definition of a management structure for conducting the MAPS study, the First Party shall serve as Project Officer for that portion of the study concerned with the assessment of morbidity effects on human health in all of the several MAPS study areas. In that capacity, within the management structure and project plan approved for MAPS, he shall make recommendations, cooperate, and assist in the conduct of the morbidity study portion of the MAPS project; specifically, he shall:

(1) Assist in the recruitment and supervision of individual employees and/or contractors in the morbidity study area by recruiting and interviewing candidates and reviewing technical proposals, and by overseeing work in progress and evaluation results.

(2) Participate in the overall management structure of the entire MAPS project, representing the viewpoint and interests of the morbidity study area in the collective development of recommendations to the project general manager concerning actions in all MAPS study areas.

(3) Following the completion of various phases of the MAPS project, participate in the drafting, reviewing, and revising of various interim or final reports.

In the provision of these services, it is understood that the First Party shall provide nominal secretarial and similar support associated with work under this contract, although the support services of the Air Quality Bureau shall be made available when significant effort is required. The First Party is hereby authorized to undertake reasonable intrastate travel in conjunction with efforts under this contract; authorization for extensive travel, out-of-state travel, or travel by third parties, if necessary, shall be requested from the project manager. The First Party is authorized to undertake nominal expenses on behalf of third parties contributing volunteer assistance in the services described above.

EQUIPMENT PROCUREMENT

The second major area of procurement requiring early initiation is the matter of equipment purchase, of pulmonary function testing apparatus as well as of air quality and meteorological monitoring equipment.

Whether to purchase the pulmonary function testing equipment on a sole source basis or after a Request of Quotation (RFQ) process is a matter better decided ultimately by the administrative personnel of the Department than by GCA. In favor of issuing RFQs is primarily the additional appearance of objectivity and cost competitiveness. In favor of sole-source purchase is primarily the savings of several weeks in the initial schedule of the pulmonary function studies. In GCA's judgment, the likelihood of finding alternative acceptable sources in reasonable proximity to Montana for service, and the likelihood of realizing meaningful cost savings, are quite low, and consequently unlikely to warrant the additional delay. A draft Request for Quotation is included for possible use, however.

The air quality and meteorological monitoring equipment purchase presents a different set of alternatives, however. In this case, a number of potential sources exist for some items, and integration of various components is of significant importance. Consequently, competitive procurement is a more attractive option than with the pulmonary equipment. Relevant portions of a draft Request for Proposal (RFP) package are included, specifically a draft RFP letter and draft instructions for proposal preparation. The primary features of the draft materials are the requirement to bid on flexible options and to prepare a relatively small proposal.

The considerations above relate primarily to the provision of tehcnical competence for installing the network equipment. For those portions of the total network package that present relatively little installation difficulty, and which are available only from sole-source suppliers, such as

the acoustic radar units and the dichotomous particulate samplers, it would be economically advantageous to use direct state purchase procedures, so long as the installation capability is available within the Bureau.

DRAFT REQUEST FOR QUOTATION
PULMONARY FUNCTION EQUIPMENT

ABC Company

Attention: Sales Dept.

Re: Request for Quotation Pulmonary function testing equipment

Gentlemen:

In conjunction with the Montana Air Pollution Study (MAPS), the Department of Health and Environmental Sciences proposes to purchase at least two units of pulmonary function testing equipment as described below. You are requested to provide price quotations for those items of your product line that will meet the requirements below. Quotation for both straight purchase and lease-purchase arrangements, if offered, are desired.

Desired is a spirometer with associated data processing electronics capable of providing both a time-volume trace on chart paper and the calculated values of FVC, FEV1, PEFR and FEF25-75 on printed paper tape. Subject identification, age, sex, height, and weight should be accepted from the operator and printed with the results on the paper tape. The entire unit must be reasonably portable, capable of withstanding frequent transportation, and require no more than 10 minutes' set-up and check-out time following transportation.

If the most nearly appropriate configuration of product items provides only slightly less capability than specified, this configuration should be quoted and the minor deficiency noted. If the most appropriate configuration provides identifiably greater capability, this should also be noted.

A logical option in addition to the above, is the capability to store the output information on a computer-compatible medium or directly in a computer as well as print it on the paper tape. While this capability is not included in the requirements set out above, it is recognized that your product line may

be developed with this capability in mind. If the configuration of equipment that meets the above-specified requirements is most appropriately used in a more automated fashion that fact should be noted and an alternative price quotation provided.

Your price quotation should include a statement of your conventional product warranty and service availability, any operator training included, and a specification of anticipated delivery schedule; early delivery and expeditious service when needed is of critical importance, and an offer of earlier delivery at premium price will be considered.

Your quotation should be received by _____ 1977, and prior telephone or other notice of intent to provide a quotation would be appreciated. Questions arising concerning this request should be directed to the undersigned at (406) 449-3454.

DRAFT REQUEST FOR PROPOSAL

MONITORING EQUIPMENT

Ref: RFP No. _____

Dear

You are invited to submit a proposal for the purchase, installation, and operation of ambient air quality monitoring, meteorological monitoring, and automatic data logging equipment to be utilized in the Montana Air Pollution Study (MAPS), being conducted by the Air Quality Bureau of the State Department of Health and Environmental Sciences; the equipment is, in general, to be retained by the Department.

Attached are the following materials relating to this proposed procurement:

Attachment A: Proposal Instructions
Attachment B: Proposed Contract Agreement
Attachment C: List of required sites and equipment

Proposals submitted in response to this RFP should be directed to the undersigned in ten (10) copies, and must be received at the Cogswell Building Offices of the Air Quality Bureau by 4:00 p.m. local time on _____1977. The Department of Health and Environmental Sciences reserves the right to reject any or all proposals, and to negotiate with any or all proposers, in accordance with applicable state procurement procedures and regulations.

The proposal instructions and the schedule of required equipment present several optional procurement configurations, in order to provide for maximum flexibility. It is envisioned that an award will be made for the entire complement of network equipment described, although it is necessary to reserve the right to make a smaller award. It is also anticipated that a contract will be awarded to a single firm, although it is necessary to reserve the right to make multiple awards.

Questions of any type concerning this RFP may be submitted to the undersigned by _____1977. Answers to all questions received will be provided to all respondents submitting questions and to any respondent who has made a request for such answers by _____1977. It is not necessary to submit questions or to request answers in order to submit a proposal.

ATTACHMENT A

PROPOSAL INSTRUCTIONS

Proposals submitted in response to this RFP shall be presented in three sections in accordance with the following instructions:

SECTION 1: A discusion of the general approach that respondent will follow in meeting the requirements of the proposed contract, including the proposed purchase and delivery arrangements, the proposed personnel arrangements and the anticipated performance schedule. This section shall not exceed 15 pages in length.

SECTION 2: A presentation of the respondent's staff capabilities for providing the required services and experience in providing similar services. If experience in performing similar efforts is presented, the name, address, and telepyone number of a cognizant technical contact at the client organization shall be includeded. This section shall not exceed ten pages in length, excluding staff resumes, which may be presented in Appendix.

SECTION 3: The financial proposal for the conduct of the proposed contract, including a statement of the type of contract proposed, appropriate data on labor and equipment estimates and cost rates, and summaries of the total proposed cost for each of the options requested. In addition to the different network confiugrations identified in Attachment C, there are the following further proposal options.

(2) The cost proposal must be presented with the cost for the network operation stated separately from the cost for the purchzse and installation of the equipment. Differing

financial proposals for purchase and installation may be made for the two options with and without the inclusion of the network operation.

(b) The proposal may be formulated without the inclusion of the "acoustic radar" echo-sounders, since they are not to be incorporated into the data logging system. Alternatively, they may be proposed separately, they may be proposed alone, or they may be incorporated into the proposal. If a proposal for provision of the acoustic radar units is made, it shall be explicitly stated to whate extent the field operation and data reduction are included.

(c) The time schedule for the completion of the network installation is of importance, and proposed accelerated schedules at premium costs will be considered.

Proposal Evaluation: The following criteria will be utilized in evaluating proposals; they are listed in descending order of importance:

1. Capability of proposer to successfully complete the contract, including judgments and opinions offered by previous clients contacted.

2. Feasibility of proposed approach to completing contract effort, including reasonableness of schedules and staffing arrangements.

3. Monetary cost.

SECTION VI

INITIAL TASK DEFINITIONS AND COST ESTIMATES

This section presents the initial task descriptions and cost estimates that were used as input to the budget prioritization process. These task definitions are numbered in technical study areas A through F, and are presented in a more expanded detailed format than in Section V. These task descriptions were initially prepared for the two-fold purpose of assuring that no required activity be omitted and of making cost estimating as simple and accurate as possible. Subsequently, after these purposes were fulfilled, the list of tasks was restructured into the list in Section V for purposes of simpler, more appropriate procurement and management. The original detailed descriptions are provided here primarily for their usefulness in presenting the assumptions underlying the cost estimates and the more detailed technical descriptions.

The task sheets for each of the technical areas A through F are preceded by a cost summary sheet for that area, and a overall summary sheet preceeds the entire set; no individual task sheets were prepared for technical area E - statistical data analysis.

OVERALL COST
SUMMARY

MAJOR TASK AREAS	RANGE OF ESTIMATED COSTS
A. HEALTH EFFECTS MONITORING	$ 397,000 - $ 693,000
B. AIR QUALITY MONITORING	$ 334,000 - $1,046,000
C. METEOROLOGICAL MONITORING	$ 152,000 - $ 398,000
D. EMISSION INVENTORY	$ 50,000 - $ 144,000
E. STATISTICAL DATA ANALYSIS	$ 60,000 - $ 77,000
F. DATA SYSTEMS DEVELOPMENT	$ 25,000 - $ 138,000
	$1,018,000 - $2,496,000

TASK AREA A

HEALTH EFFECTS MONITORING

Task No.	Title	Range of Estimated Costs
A1	Existing Death Certificate Study	$ 1,000
A2	Death Certificate Study in Colstrip, Columbia Falls and Helena	$25,000
A3	Death Certificate Study in Billings and Missoula	$35,000
A4	Obtain Physician Visit Data from Western Montana Clinic	$ 4,000
A5	Obtain Physician Visit Data from Billings Clinic	$ 4,000
A6	Obtain MFMC Hospital Admissions Data	$ 2,000
A7	St. Patrick Hospital Admissions Study Update	$ 4,000
A8	Initial Development for Pulmonary Function Studies	$ 3,000
A9	Pulmonary Function Training and Quality Assurance	$10,000
A10	Pulmonary Function Studies	$ 95,000 - $405,000
A11	Extra City Pulmonary Function Study	$40,000
A12	E. Coli/Urine Carcinogen Survey	$50,000
A13	Wandering Jew Mutagen Survey	$20,000
A14	Drosophilia mutagen survey	$70,000
A15	SCE - Human Leukocyte Survey	$20,000
		$397,000 - $693,000

TASK A1: EXISTING DEATH CERTIFICATE STUDY

Description: Oversight of existing study under grant in Lake, Silver Bow and Deer Lodge Counties, including integration into MAPS and possibly some data analysis.

Design Basis for Costing: Nominal effort absorbed into general MAPS and AQB staff management effort.

Cost Estimate: $1000

TASK A2: DEATH CERTIFICATE STUDY IN COLSTRIP, COLUMBIA FALLS AND HELENA

Description: Extension of existing grant study to MAPS' minor study areas

Quantitative Options: Undertake study in all, some, or none of the areas

Task Assumptions:

- Separated from the major study cities in Task A3 on the presumption that the minor study areas have a higher priority, since little else will be done in these areas

Basis for Costing: Extrapolation of existing $16,000 grant on the basis of county populations

Cost Estimate: $25,000

TASK A3: DEATH CERTIFICATE STUDY IN BILLINGS AND MISSOULA

Description: Extension of existing grant study to MAPS' other major study areas

Quantitative Options: Undertake study in all, some, or none of the areas

Task Assumptions: Separated from the smaller areas in Task A2 on the assumption that Billings and Missoula could be more easily omitted

Basis for Costing: Extrapolation of existing $16,000 grant on the basis of county populations

Cost Estimates: $35,000

TASK A4: OBTAIN PHYSICIAN VISIT DATA FROM WESTERN MONTANA CLINIC

Description: Provide specified information in compact, computer-readable data base

Task Assumptions: Only logical source is clinic itself

Quantitative Options: Some flexibility in specifying list of diagnoses to be included, but little effect on cost

Basis for Costing: Estimate provided by WM clinic administration

Cost Estimate: $4000

TASK A5: OBTAIN PHYSICIAN VISIT DATA FROM BILLINGS CLINIC

Description: Provide specified information in compact, computer-readable data base

Task Assumptions: Only logical source is clinic itself

Quantitative Options: Some flexibility in specifying list of diagnoses to be included, but little effect on cost

Basis for Costing: Extension from WM Clinic

Cost Estimate: $4000

TASK A6: OBTAIN MFMC HOSPITAL ADMISSIONS DATA

Description: Obtain specified information on hospital admissions from MFMC tapes

Basic Approach Options: Question of what codes are requested; does not affect costs, so should probably request all codes in broad categories, and COPD in detail

Quantitative Options: Flexibility in how often tapes are desired

Task Assumptions: Assume initial request for one to three years' back data, followed by quarterly thereafter

Basis for Costing: Quotation of $75 per tape run from MFMC (rounded up)

Cost Estimate: $2000

TASK A7: ST. PATRICK HOSPITAL ADMISSIONS STUDY UPDATE

Description: Update of previous SERC study, including both data collection and analysis

Task Assumptions: U of M Environmental Studies Program only reasonable source

Basic Approach Options: Question of whether contract through University or to WT as individual

Basis for Costing: Estimate by W. Tomlinson of U of M Environmental Studies Program

Cost Estimate: $4000 (WT said $3500)

TASK A8: INITIAL DEVELOPMENT FOR PULMONARY FUNCTION STUDIES

Description: Provide for the various preliminary steps involved in initiating the pulmonary function studies. Includes the preparation of draft letters and forms, recruiting and interviewing potential personnel and arranging for office space and other necessary support.

Task Assumptions: Since pulmonary function studies are to be pilot tested in Missoula, this task should be undertaken primarily there

Design Basis for Costing: Assumed performed by a mixture of consultants and/or local labor under leadership of one responsible individual; paid manpower assumed mostly at consultant rate, averaging $250/day

Cost Estimate: $3000

TASK A9: PULMONARY FUNCTION TRAINING AND QUALITY ASSURANCE

Description: Provide initial training effort and on-going quality assurance activities in support of the COPD patient and school children pulmonary function studies. Includes the development of the testing protocol and quality assurance procedures, the conduct of training sessions for the personnel who will conduct the testing, and subsequent overseeing of the quality assurance effort

Task Assumptions:

- This task represents the major connection between the pulmonary function studies in the several cities, and as such should have personnel and communication links from city to city. It is assumed that the task should be undertaken by a committee of respiratory technologists and physicians, at least one from each major study city, and headed if possible by such a person from another city not involved in the study. Such a group would involve outside consultants as required, and make the necessary arrangements for training, etc. with assistance from the MAPS project management

Design Basis for Costing: Primarily local consultant effort at $250 per day and local travel

Cost Estimate: $10,000

TASK A10: PULMONARY FUNCTION STUDIES

Description: Includes pulmonary function testing for both COPD patient and and school children studies; data preparation for computer entry is included; initial design, training, quality assurance, and data analysis are provided in other tasks

Basic approach options: Three levels of equipment and parameters as on attached sheet

Quantitative options:

- One year or two years option in each city
- Number of school children in study (estimated for two levels at 300 and 500) and number of COPD patients (estimated for two levels at 50 and 100)

Task assumption: Equipment Option C not estimated at present. There is not a clear-cut savings in labor to warrant the extra cost, although this is re-assessable depending on the options chosen for processing AQ and met data.

Workload assumptions:

School children study, one week/month

High level (500) requires three technician/equipment units

Low level (300) requires two units

COPD patient study; irregularly-scheduled tests, at home or office, at odd hours of day, totaling 100 or 200 per month

High option requires two technician/equipment units, plus one scheduler/manager, supplemented by third testing unit from Helena and one volunteer during school testing weeks

Low option requires only scheduler/manager plus two testing units, and also provides a more comfortable work load

Options involving only school children study, without concurrent patient study, require three testing units for one week per month; no permanent office needed in study city, but must share cost of office somewhere

Design basis for costing:

Testing unit (see attached sheet for options)

Option A: $600 + $20,000/year

Option B: $7,000 + $12,000/year

Pulmonary testing supplies $1000/year

Office, phone, supplies, etc. $7000/year

Cost estimates:

See attached summary table for details of various optional possibilities in each city

Possible combinations are:

Maximum: High options, both patients and school children in 3 study areas for two years — 3 x $135,000 = $405,000

Minimum: Low options, one year of both in Missoula, one year of only school children in other 2 areas — $49,000 + 2 x $23,000 = $95,000

Others:

High option, one year of both in Missoula followed by school study only in all three second year — $68,000 + 3 x $31,000
- $21,000 in equipment = $140,000

High option, one year of both in Missoula followed by patient study only in all three the second year — $126,000 + 2 x $59,000
- $7,000 in equipment = $237,000

TASKS A10 - A11

UNIT COSTS FOR SPIROMETRY TECHNICIAN/EQUIPMENT PAIR

Assumption: For maximum utilization, spirometry equipment should be in use essentially full-time. This indicates that the technician/equipment pair makes the logical unit for planning purposes.

Technical options: Costs estimated for three options:

A. Use Collins portable survey model water-filled spirometer and only study FEV_1 and FVC; requires manual chart reading

B. Use automated spirometer (e.g., Jones) and study FEV_1, FVC, PEFR, and FEF_{25-75}; provides printed paper tape output along with chart

C. As B, but with addition of cassette tape recorder

Unit Costs:

Option A

Water-filled spirometer		$ 600
Respiratory technician (1 year)		12,000
Chart reading (80% at $10,000)		8,000
	One year	$20,600
	Two years	$40,600

(Note: technician could do chart reading, but with loss of instrument capacity)

Option B

Automated spirometer		$ 7,000
Respiratory technician		12,000
	One year	$19,000
	Two years	$31,000

Option C

Automated spirometer		$ 7,000
Cassetts data recorder		2,500
Respiratory technician		12,000
	One year	$21,500
	Two years	$33,500

TASK A10

PULMONARY FUNCTION STUDIES

EXTENSION TO VARIOUS OPTIONS

(Cost in $1000's)

	Missoula				Other Cities						
	1	2	3	4	1	2	3	4	5	6	7
Option:											
First Year COPD	X	X	X	X	X	X	X				
SC	X	X	X	X	X	X	X	X	X		
Second Year COPD	X	X			X	X		X		X	
SC	X		X		X		X	X	X	X	X
High Level, Option A											
Office, supplies	16	16	8	8	16	16	8	8	8	8	4
Mgr/Scheduler	20	20	10	10	20	20	10	10	-	10	-
Testing units	81	81	41	41	81	81	41	41	-	41	-
Floating units	14	7	28	7	14	7	28	28	41	7	21
Travel	4	2	8	2	4	2	8	8	12	2	6
	135	126	95	68	135	126	95	95	61	68	31
High Level, Option B											
Office, supplies	16	16	8	8	16	16	8	8	8	8	4
Mgr/Scheduler	20	20	10	10	20	20	10	10	-	10	-
Testing units	62	62	31	31	62	62	31	31	-	31	-
Floating units	10	6	19	6	10	6	19	19	31	6	19
Travel	4	2	8	2	4	2	8	8	6	2	6
	112	106	76	57	112	106	76	76	45	57	29
Low Level, Option A											
Office, supplies	16	16	8	8	16	16	8	8	8	8	4
Mgr/Scheduler	20	20	10	10	20	20	10	10	-	10	-
Testing units	81	81	41	41	81	81	41	41	-	41	-
Floating units	-	-	-	-	-	-	-	-	41	-	21
Travel	-	-	-	-	-	-	-	-	12	-	6
	117	117	59	59	117	117	59	59	61	59	31
Low Level, Option B											
Office, supplies	16	16	8	8	16	16	8	8	8	8	4
Mgr/Scheduler	20	20	10	10	20	20	10	10	-	10	-
Testing units	62	62	31	31	62	62	31	31	-	31	-
Floating units	-	-	-	-	-	-	-	-	31	-	19
Travel	-	-	-	-	-	-	-	-	12	-	-
	98	98	49	49	98	98	49	49	51	49	23

Note: Not reflected in this table are the potential savings in capital cost resulting if studies are run only one year and equipment can be transferred between cities; up to $21,000 savings possible

TASK A11: EXTRA CITY PULMONARY FUNCTION STUDY

Description: Conduct pulmonary function study on school children in extra city

Basis for Costing: Rough estimate basis on aggregates for other cities, and assuming minimal program in extra city

Cost Estimate: $40,000

TASK A12: E. Coli/Urine Carcinogen Survey

TASK A13: Wandering Jew Mutagen Survey

TASK A14: Drosophilia Mutagen Survey

TASK A15: SCE - Human Leukocyte Survey

Description: Four alternative/complementary survey techniques for assessing carcinogen/mutagen prevalence and variations.

Design Basis for Costing: Estimates accompanying proposal from MSU.

Cost Estimates:

Task A12 - $50,000

Task A13 - $20,000

Task A14 - $70,000

Task A15 - $20,000

TASK AREA B

AIR QUALITY MONITORING

Task No.	Title	Range of Estimated Costs
B1	Supply and Installation of Particulate Equipment	$ 8,000 - $144,000
B2	Supply and Installation of SO_2 Equipment	$31,000 - $142,000
B3	Supply and Installation of Major Air Monitoring Sites in Study Cities	$43,000 - $359,000
B4	Field Operation of Monitoring Equipment in Study Cities	$30,000 - $ 45,000
B5	Supply, Installation, and Operation of Monitoring Equipment in Extra City	$135,000
B6	Handling and Reduction of Data from Particulate/SO_2 Studies	$ 5,000 - $ 21,000
B7	Supply and Installation of AQ Data Logging/Processing System	$ 6,000 - $ 44,000
B8	Routine Sulfate Analysis	$ 6,000 - $ 23,000
B9	Routine Analysis for Major Particulate Constituents	$10,000 - $ 24,000
B10	Screening Analysis for Minor Particulate Constituents	$11,000 - $ 40,000
B11	Sulfate Characterization Study	$ 5,000 - $ 25,000
B12	Special Studies of Short-Term Particulate Loadings	$26,000
B13	Study of Indoor-Outdoor Differences	$18,000
	Total	$334,000 - $1,046,000

Assumptions Relating to All of Task Area B:

- All major pollutants should be monitored to permit acceptable scientific judgment on the causes of any results found; i.e., to preclude having effects ascribed to some pollutant that was pre-judged unimportant and not included.

- As a measure of scientific objectivity, at least minimal levels of each type of activity should be conducted in each study city; e.g., no analyses should be made in some cities but not others.

- Quantitative options. The attached are all estimated on the basis that the air monitoring equipment should remain to support a permanent, on-going basis. If the health effects studies are staggered among cities, or terminated after 2 years, the possibility of shifting some equipment from city to city offers a capital cost savings, particularly if the medium or high options of Tasks B1 and B2 are chosen. The potential savings would be about one-third the capital cost, or $12,000 to $45,000.

TASK B1: SUPPLY AND INSTALLATION OF PARTICULATE EQUIPMENT

Description: Includes equipment purchase, installation on a prepared site, initial checkout, and operator instruction.

Basic Approach Options:

Equipment options:

A. Hi-vol plus cascade centripeter (5 mμ)

B. Two hi-vols, one with cyclone preseparator (3.5 mμ)

C. Hi-vol plus dichotomous sampler (3.5 mμ)

Installation options:

State purchase, install with state manpower

Contractor purchase and installation package

Task Assumptions:

- All sites need both mass TSP as reference method and respirable fractionation for health effects correlation, which must collect large enough samples for constituent analysis
- Routine network use of beta-attenuation monitors excluded on basis of cost, which would be triple that of Option C

Quantitative Options:

- Three levels of network extent, as noted in attached table, are essentially minimal (one or two per city), extensive (thorough coverage), and an intermediate level

Design Basis for Costing:

For state purchase option, costed at equipment cost, with AQB manpower estimates

For contractor purchase, costed at equipment cost plus 15%, with manpower at $1000/man-week

Manpower estimated at 1/2, 1, 1 1/2 man-weeks for low, medium, high options respectively

Cost Estimates:

See attached sheets for details of equipment costs and numbers of sites

Equipment Option	Network Option	Cost Estimate	
		State*	Contractor
A	Low	7,800	9,500
	Med	18,200	21,900
	High	32,500	38,900
B	Low	12,800	15,300
	Med	30,000	35,400
	High	53,500	63,000
C	Low	29,800	34,800
	Med	69,500	80,900
	High	124,100	144,200

*Plus 1/2 to 1 1/2 man-weeks from AQB

TASK B1

UNIT COST SUMMARY

Equipment

High-volume air sampler, including recorder and recorder supplies (e.g., Sierra Model 305H)	$ 475
HVAS Timer/programmer (e.g., Sierra Model 305-800)	$ 195
Cascade centripeter (Bird ∇ Tole, Ltd., distributed by BGI, Inc.)	$ 475
Cyclone preseparator for HVAS (e.g., Sierra Model 230CP)	$ 995
Virtual-impactor dichotomous sampler (Sierra Model 243)	$4295
Carbon vane pump (e.g., Gast Model 0522)	$ 155

Site-Unit Packages

A. Hi-vol, timer, cascade centripeter, pump	$1300
B. 2 Hi-vols, timer, cyclone preseparator	$2140
C. Hi-vol, timer, dichotomous sampler	$4965

TASK B1

SITE SUMMARY - TSP

	Network Extent Option		
	Minimal	Medium	Extensive
Anaconda			
Existing P.O. site	X	X	X
West Elementary school		X	X
West Valley area			X
Billings			
Grand Ave. school	X		X
Lockwood school	X	X	X
Bitteroot school		X	X
Broadwater school		X	
Meadowlark school		X	X
Poly school			X
Washington school			X
Old S. 27th St. site			X
New fairgrounds site			X
Butte			
Monroe school	X	X	X
Greeley school		X	X
Longfellow school	X		X
Burlington school		X	X
Emerson school			X
Existing Walkerville site		X	X
Missoula			
Frenchtown school		X	X
Target Range school		X	X
Cold Springs school			X
Washington school	X	X	X
Russell school			X
Existing Court House site		X	X
Prescott school			X
Lowell school neighborhood			X
Number of sites			
Anaconda	1	2	3
Billings	2	4	8
Butte	2	4	6
Missoula	1	4	8
Total	6	14	25

TASK B2: SUPPLY AND INSTALLATION OF SO_2 EQUIPMENT

Description: Includes equipment purchase, installation on a prepared site, initial checkout, and operator instruction.

Basic Approach Options:

Installation Options:

State purchase, install with state manpower

Contractor purchase and installation package

Task Assumptions:

- Not all sites that have TSP and respirable particulates will need SO_2, since gaseous pollutants more uniformly distributed

Quantitative Options:

- Three levels of network extent, as noted in attached table, are essentially minimal (one or two per city), extensive (thorough coverage), and an intermediate level

Design Basis for Costing:

Equipment: Low-maintenance, SO_2 monitor (e.g., Phillips 9755), including air sampler and filter units and built-in calibration source $9000

Average shelter cost; assume 1/5 sheds at $3900, 4/5 roof-top shelters at $500 $1200

For state purchase option, costed at equipment cost, with AQB manpower estimates

For contractor purchase, costed at equipment cost plus 15%, with manpower at $1000/man-week

Manpower estimated at 1/2, 1, 1 1/2 man-weeks for low, medium, high options respectively

Cost Estimates:

See attached sheet for location and number of sites

	Cost Estimate	
Network Option	State*	Contractor
Low	$ 30,600	$ 35,700
Medium	$ 81,600	$ 94,800
High	$122,400	$142,300

*Plus 1/2 to 1 1/2 man-weeks from AQB

TASK B2

SITE SUMMARY - SO_2

	Network Extent Option		
	Minimal	Medium	Extensive
Anaconda			
Existing P.O. site		X	X
West Elementary school			X
Billings			
Grand Ave. school	X	X	
Lockwood school	X	X	X
Bitteroot school		X	X
Broadwater school			X
Meadowlark school			X
Butte			
Monroe school		X	X
Longfellow school			X
Missoula			
Target Range school		X	X
Washington school	X	X	X
Existing Court House site		X	
Prescott school			X
Lowell school neighborhood			X
Number of sites			
Anaconda	0	1	2
Billings	2	3	4
Butte	0	1	2
Missoula	1	3	4
Total	3	8	12

TASK B3: SUPPLY AND INSTALLATION OF MAJOR AIR MONITORING SITES IN STUDY CITIES

Description: Includes site preparation, equipment and shelter purchase and installation, initial checkout, and operator instruction.

Basic Approach Options:

Installation options:

State purchase, install with state manpower

Contractor purchase and installation package

Quantitative Options: Costs are estimated for two different levels of parameters covered and for three different network configurations; in each case, the minimum option is the minimum necessary for the health effects aspects of the study.

Design Basis for Costing:

Unit costs, sites, and equipment assumptions are tabulated in 5 attached tables

Manpower costs estimated at 1 and 2 man-weeks/site for the low and high options, respectively

For contractor purchase option, cost estimated at equipment cost plus 15% and $1000/man-weeks

For state purchase option, cost is straight equipment cost, with manpower assumed in Task B5

Cost Estimates:

Equipment Option	Network Option	State	Contractor	Man-Weeks
Low	Low	$ 53,000	$ 64,000	3
	High	$138,000	$146,000	7
High	Low	$137,000	$164,000	6
	High	$300,000	$359,000	14

TASK B3

SUMMARY OF EQUIPMENT COSTS

Low Equipment Option

	Network Option	
City	Low	High
Anaconda	$23,000	$ 39,000
Billings	$ 7,000	$ 30,000
Butte	0	$ 23,000
Missoula	$23,000	$ 46,000
	$53,000	$138,000

High Equipment Option

	Network Option	
City	Low	High
Anaconda	$ 45,000	$ 67,000
Billings	$ 25,000	$ 64,000
Butte	$ 10,000	$ 67,000
Missoula	$ 57,000	$102,000
	$137,000	$300,000

TASK B3

ANACONDA SITES AND EQUIPMENT

Equipment Option	Parameter	LOW (one site at W. Elem. School)	HIGH (add 2nd in W. Valley area)
Low	SO_2	(B2)	(B2)
	NO_x	$ 8,000	$ 8,000
	O_x	$ 7,000	None
	TSP	(B1)	(B1)
	RSP	(B1)	(B1)
	Site	$ 8,000	$ 8,000
	Total	$23,000	$16,000
	Cum. Total	-	$39,000
High	SO_2	(B2)	(B2)
	NO_x	$ 8,000	$ 8,000
	O_x	$ 7,000	None
	TSP	(B1)	(B1)
	RSP	(B1)	(B1)
	CO	$ 6,000	None
	H_2S	$ 6,000	$ 6,000
	THC	$10,000	None
	Site	$ 8,000	$ 8,000
	Total	$45,000	$22,000
	Cum. Total	-	$67,000

TASK B3

BILLINGS SITES AND EQUIPMENT

Equipment Option	Parameter	LOW (one site in CBD)	HIGH (add 2nd to west)
Low	SO_2	Existing	(B2)
	NO_x	Existing	$ 8,000
	O_x	$ 7,000	$ 7,000
	TSP	(B1)	(B1)
	RSP	(B1)	(B1)
	Site	Existing	$ 8,000
	Total	$ 7,000	$23,000
	Cum. Total	-	$30,000
High	SO_2	Existing	(B2)
	NO_x	Existing	$ 8,000
	O_x	$ 7,000	$ 7,000
	TSP	(B1)	(B1)
	RSP	(B1)	(B1)
	Beta TSP	$12,000	None
	CO	Existing	None
	H_2S	$ 6,000	$ 6,000
	THC	Existing	$10,000
	Site	Existing	$ 8,000
	Total	$25,000	$39,000
	Cum. Total	-	$64,000

TASK B3

BUTTE SITES AND EQUIPMENT

Equipment Option	Parameter	LOW (one site at Alpine/Greeley)	HIGH (add 2nd at Monroe School)
Low	SO_2	(B2)	(B2)
	NO_x	Existing	$ 8,000
	O_x	Existing	$ 7,000
	TSP	Existing	(B1)
	RSP	(B1)	(B1)
	Site	Existing	$ 8,000
	Total	$ 0	$23,000
	Cum. Total	-	$23,000
High	SO_2	Existing	(B2)
	NO_x	Existing	$ 8,000
	O_x	Existing	$ 7,000
	TSP	Existing	(B1)
	RSP	(B1)	(B1)
	Beta TSP	None	$12,000
	CO	Existing	$ 6,000
	H_2S	$ 6,000	$ 6,000
	THC	Existing	$10,000
	Site	$ 4,000	$ 8,000
	Total	$10,000	$57,000
	Cum. Total	-	$67,000

TASK B3

MISSOULA SITES AND EQUIPMENT

Equipment Option	Parameter	LOW (one site at Park near Washington School)	HIGH (add 2nd at Target Range School)
Low	SO_2	(B2)	(B2)
	NO_x	$ 8,000	$ 8,000
	O_x	$ 7,000	$ 7,000
	TSP	(B1)	(B1)
	RSP	(B1)	(B1)
	Site	$ 8,000	$ 8,000
	Total	$23,000	$23,000
	Cum. Total	-	$46,000
High	SO_2	(B2)	(B2)
	NO_x	$ 8,000	$ 8,000
	O_x	$ 7,000	$ 7,000
	TSP	(B1)	(B1)
	RSP	(B1)	(B1)
	Beta TSP	$12,000	None
	CO	$ 6,000	$ 6,000
	H_2S	$ 6,000	$ 6,000
	THC	$10,000	$10,000
	Site	$ 8,000	$ 8,000
	Total	$57,000	$45,000
	Cum. Total	-	$102,000

TASK B4: FIELD OPERATION OF MONITORING EQUIPMENT IN STUDY CITIES

Description: Manpower to maintain and operate field network

Task Assumptions:

- Should probably be provided through state or local agency as a matter of support and coordination as well as cost
- Assumes that this task provides routine support to met sites, supplemented by a meteorologist under area C

Basic Approach Options:

- Personnel employed by state or local agency
- Contractor - provided manpower and state equipment

Quantitative Options: Relatively little flexibility; labor can be shared with met sites, but unless a very minimal network is chosen, at least one person (one man-year) will need to be provided in each of three study areas.

Design Basic for Costing:

State/local employment:

$10,000/year including salary overhead

Contractor personnel:

$9,000/year plus 40 to 50% = $13,000/year

Office support provided from existing facilities in either case

Assume three man-years (one per city) unless major network options chosen, in which case add one additional Helena-based roving repairman technician to state option plus $2000/year for travel

Cost Estimates:

	State	Contractor
Moderate network	$30,000	$39,000
Major Network	$42,000	$45,000

TASK B5: SUPPLY, INSTALLATION, AND OPERATION OF MONITORING EQUIPMENT IN EXTRA CITY

Description: Provide for an extra city monitoring equipment comparable to that provided under B1, B2, B3 for the study areas

Basic Approach Options:

- Two purchase options as in Tasks B1, B2, B3
- Quantitative options as in Tasks B1, B2, B3

Cost Estimates: (Roughly approximated from other tasks)

Particulate equipment	$ 30,000
SO_2 equipment	$ 40,000
Major site equipment	$ 50,000
Field operation	$ 15,000
Total:	$135,000

TASK B6: HANDLING AND REDUCTION OF DATA FROM PARTICULATE AND SO_2 STUDIES

Description: Provide routine reduction of data from multi-site field studies in four study cities. Strip chart and filter changing and transportation included in field operations manpower; this task provides only for chart reduction and filter weighing, etc.

Basic Approach Options: Particulate data must be handled by hand, but for SO_2 data, there are several technical options:

A. Manually read charts, code forms, and punch cards

B. Automated digitizing — charts to cards

C. On-site recording with manual delivery of stored data

D. On-site recording with telephone dumping of stored data once daily

E. On-site microprocessor, no on-site storage, routine transmission to computer

Task Assumptions:

- Options C, D and E above all require electronic logging hardware on-site, and so are reasonable only for sites where several sensors are located. Costs below for Option C are the lowest of the three and are based on location of 2 wind parameters at the same site as the SO_2

Design Basis for Costing:

Particulate Data:

Twenty filters per man-hour, including weighing and data recording; manpower at $10,000/year including overhead. Supplies assumed at $1.00 per sample. Assume purchase of 0.1 mg balance at $2000.

SO_2 Data: (See Task B7 for details)

Option A: $605 per parameter-year

Option B: $730 per parameter-year

Option C: Capital cost $5140 per site

Supplies assumed at $2000 total

Cost Estimates: (Based on 2 years operation)

Network Option	Particulate		Sulfur Dioxide		
	60/year	120/year	A	B	C*
Minimal	$ 4,700	$ 7,400	$ 3,630	$ 4,380	$ 5,140
Medium	8,300	14,600	9,680	11,680	13,707
Extensive	13,250	24,500	14,520	17,520	20,560

*Assuming 1/3 of cost of handling SO_2 plus wind speed and direction

Note: Option C column does not increase with number of years, while others are all proportional

TASK B7: SUPPLY AND INSTALLATION OF AQ DATA LOGGING/PROCESSING SYSTEM

Description: Provide system for converting or transferring data from field site to computer-readable form in Helena, on a routine basis.

Basic Approach Options:

- Five major technical options, with variations, as follows:

  A. Manually read charts, code forms, and punch cards

  B. Automated digitizing — charts to cards

  C. On-site recording with manual delivery of stored data

  D. On-site recording with telephone dumping of stored data once daily

  E. On-site microprocessor, no on-site storage, routine transmission to computer

     (1) dedicated WATS lines to WT computer in Bozeman

     (2) same as (1), cost shared with DNR

     (3) dedicated WATS lines to new DHES computer

  Note: Options C, D and E permit incoming interrogation in conjunction with Task F5; D and E at no additional cost, C at additional cost of $450/site

- Option of adjacent or separate location with major met sites (of concern only with Options C, D and E)

Quantitative Options: No significant flexibility, other than number of sites to be considered under the latter three technical options.

Design Basis for Costing: See attached sheets for unit costs under various technical options and extension keyed to number of sites in Task B3.

No allowance has been made for any labor (either routine or repair) on Options C, D, and E; any requirement should be similar for all three, and is included with the field operation task.

Cost Estimate: (See extension sheet for details)

Range: $19,000 to $40,000 for three site option

$ 6,000 to $35,000 for same shared with met

$24,000 to $44,000 for six sites (3 shared)

TASK B7

UNIT COST SUMMARY

Option A - Manual	
0.05 man-years at $10,000 per year	= $500
key-punch 1752 cards at $0.06 (24 hr x 365 day ÷ 5 parameters)	= 105
	$605 per parameter-year
Option B - Automated Digitization	
$2.00 per parameter-day (incl. marking noon, midnight) (Envirodata Corp.) $2.00 x 365	= $730 per parameter-year
Option C - On-site Recording with Manual Delivery	
On-site processor (polls sensors, provides data stream), with clock (programs recording interval), and recorder (puts data on tape) Total together, e.g. MRI Model 1770-4	$5140/site
Tape cassette reader	$3500
Option D - On-site Recording with Daily Phone Dump	
On-site processor with clock and recorder as in Option C, plus incoming interrogation capability (e.g., MRI Model 1770-12)	$5590/site
Tape cassette reader	$3500
Acoustic coupler	$ 350
Option E - No On-site Recording, Remote Computer Polling	
On-site processor with remote interrogation capability, but no clock or on-site recording capability (e.g., MRI Model 1770-9)	$2875/site
Dedicated WATS lines	
Option (1) (to Bozeman)	$9540/year
Option (2) (Split 50-50 with DNR)	$4770/year
Option (3) (to DHES in Helena)	$9540/year
Central computer-phone interface	
Options (1) and (3)	$2500
Option (2) (50-50 with DNR)	$1250
DHES Computer for central control (Low end of wide range, depending on other capabilities)	$10,000 (+)

TASK B7: COST EXTENSION TO SITE CONFIGURATIONS

Data Logging Option	Low Site Option 3 AQ Sites[a]		Low Site Option 3 AQ Sites[b] shared with met		High Site Option 3 Shared Sites plus 3 AQ sites	
	2 yr	5 yr	2 yr	5 yr	2 yr	5 yr
Total Costs						
A	18,200	45,400	18,200	45,400	36,300	90,800
B	21,900	54,800	21,900	54,800	43,800	109,600
C	18,900	18,900	6,300	6,300	24,000	24,000
D	20,600	20,600	6,900	6,900	26,200	26,200
E1	30,200	58,800	24,500	53,100	33,100	61,700
E2	19,400	33,700	13,700	28,000	22,300	36,600
E3	35,200	63,800	29,500	58,100	38,100	66,700
Unit Costs (per parameter-year)						
A	605	605	605	605	605	605
B	730	730	730	730	730	730
C	630	252	210	84	400	160
D	687	275	230	92	437	175
E1	1007	784	817	708	552	411
E2	647	449	457	373	372	244
E3	1173	851	983	775	635	445

[a] AQ sites assumed 5 parameters, major met sites 10

[b] 1/3 of cost of shared site; other 2/3 counted in Area C

TASK B8: ROUTINE SULFATE ANALYSIS

Description: Provide routine analysis of water-soluble sulfates on particulate samples from routine monitoring operations.

Task assumptions:

- Presumption is made that analysis will be in-house; cost would be less, equipment is available, control would be better, and staff preference has been expressed.

Quantitative options: Analyze all or only part of samples available; samples available range from 90 to 750 per month, depending on network options selected.

Design basis for costing:

200 samples per week of auto-analyzer and lab technician time.

Lab technician at $1,000 per month including overhead.

Cost estimates:

	Range over no. of samples
Technician, ¼ to full time	$3,000 - $12,000
Supplies, start-up expenses	$1,000 - $ 3,000
	$4,000 - $15,000/year
Assume 1½ years	$6,000 - $23,000

TASK B9: ROUTINE ANALYSIS FOR MAJOR PARTICULATE CONSTITUENTS

Description: Provide routine analysis of particulate samples for metals, other constituents.

Task assumptions:

- Presumption is made that analysis will be in-house; cost would be less, equipment is available, control would be better, and staff preference has been expressed.

Basic approach options: Extent of contaminant list included for routine rather than screening analyses.

- Lower: As, Cd, Ni, Cu, Si
- Greater: Same plus Pb, V, Na, Cr, Be, Fe, Al

Quantitative options: Analyze all or only part of samples available; samples available range from 90 to 750 per month, depending on network options selected.

Design basis for costing:

Commercial AA analysis at $10/element/sample

Lab technician $1000/month including overhead

Purchase arsine generator at $2000 (needed for As by AA)

150 elements/week of lab technician time

Number elemental analyses possible per month:

Lower option - 5 x 90 to 750 = 450 to 3750

Higher option - 12 x 90 to 750 = 1080 to 9000

Cost estimates:

	Cost per month Range over no. of samples	
	Lower option	Higher option
Technician at $4/element	$1,800 - $15,000	$4,300 - $36,000

Assume 18 months, medium network option, analyze 2 filters per month:

Lower option $10,100

Higher option $24,200

TASK B10: SCREENING ANALYSIS FOR MINOR PARTICULATE CONSTITUENTS

Description: Provide non-routine screening analyses for broad spectrum of constituents in particulate matter

Task assumptions:

- Contract on per-sample basis with outside laboratories

Quantitative options:

A. One set of data from one site in each city (total 12 analyses)

B. Above plus second set of 2 sized fractions only (total 20)

C. Above plus 3 more sized fraction sets from other sites or dates (total 44)

Design basis for costing:

GC/Mass Spec. Organic scan:	$500/sample
Broad scan for major groups - $200/sample Typical refined scan for detail - $300/sample	
Thorough elemental scan utilizing nuclear activation and X-ray fluorescence techniques	$400/sample
Total	$900/sample

Cost estimates:

Option A: $10,800

Option B: $18,000

Option C: $39,600

TASK B11: SULFATE CHARACTERIZATION STUDY

Description: Statistical and/or analytical effort to try to characterize the molecular nature of the sulfate aerosol collected in particulate sampling.

Task assumptions:

- Sulfate characterization is a major unresolved difficulty, and it may be beyond MAPS' role to pursue it thoroughly; however, since toxicity of sodium sulfates from pulp mills is likely to be a critical issue, MAPS should at least recognize and briefly address the issue.

Basic approach options:

- Statistical analysis of elemental and water-soluble sulfate data to try to define sulfate composition roughly

- Analytic study to attempt to resolve molecular speciation; requires experimentation with existing techniques (ESCA and X-ray fluorescence have shown some promise) and offers perhaps 75 percent chance of developing reasonably quantitative data on a few (5 to 10) samples.

Cost estimates:

Statistical approach	$ 5,000
Analytical approach	$20,000
	$25,000

TASK B12: SPECIAL STUDIES OF SHORT-TERM PARTICULATE LOADINGS

Description: To provide for equipment and manpower to conduct special field studies in support of size fractionation and short-term time resolution aspects of particulate health effects portion of MAPS

Task assumptions:

- Some need exists to document and support the choice of whatever respirable fractionating equipment option is chosen, in light of potential future comparisons with other effects studies.
- There are a number of special short-term special monitoring studies that are envisioned arising from various aspects of MAPS; e.g.:
  - emission factor refinement
  - identification of particulate component sources; e.g., urban street dust, that involve correlation with human exposure patterns; such studies typically involve either correlation with short-term activity, like traffic levels, or correlation with short-term wind fluctuations as a matter of directional identification.

Basic approach options: Presumed least costly is to provide instrumentation and some manpower, and plan to conduct brief studies when and as required, using existing staff and MAPS field operation manpower; the only alternative is an outside contractor effort on each task, which is more expensive and likely unavailable for small efforts.

Cost estimate:

One each of sizing options from Task B1:	A	$ 1,300
	B	2,140
	C	4,965
Beta attenuation instrument		12,100
		$20,505
One-half man-year at $10,000		5,000
		$25,505

TASK B13: STUDY OF INDOOR/OUTDOOR DIFFERENCES

Description: Provide initial examination of likely effect of indoor/outdoor differences on MAPS study approach and conclusions

Task assumptions: Like sulfate characterization, the relationship between traditional outdoor ambient pollution control and the highly-varied pattern of human exposures may be somewhat beyond the scope of MAPS' mission. However, it is being addressed in the NIEHS/HSPS study being one of the limitations of earlier CHESS studies. Consequently, some recognition of the problem and an effort to relate to other studies is warranted.

Basic approach: A variety of quantitative approaches can be envisioned, ranging downward from a major effort to statistically define indoor/outdoor relationships in each MAPS city and each season. The minimal credible effort is a pilot study involving a mixture of MAPS equipment and HSPS equipment, operated in a few volunteer homes in the manner of the HSPS studies. This would be aimed at establishing in a general way the applicability of their results to Montana, and of verifying that exposure levels are not dramatically different.

Cost estimate:

2 sets HSPS samplers	$ 1,500
MAPS-type SO_2 sampler*	9,000
One-half man-year at $10,000	5,000
Supplies, support expenses	2,000
	$17,500

*MAPS particulate equipment from Task B12

TASK AREA C: METEOROLOGICAL MONITORING

Task	Title	Range of Estimated Costs
C1	Supply and Installation of Upper Air Stations	$ 44,000 - $104,000
C2	Supply and Installation of Secondary Wind Sites	$ 8,000 - $ 38,000
C3	Supply and Installation of Data Logging System for Upper Air Sites	$ 20,000 - $118,000
C4	Handling and Reduction of Data from Secondary Wind Sites	$ 7,000 - $ 33,000
C5	Field Operation of Met Equipment in Study Cities	$ 41,000 - $ 53,000
C6	Supply, Installation, and Operation of Met Equipment in Extra City	$ 32,000 - $ 52,000
		$152,000 - $398,000

TASK C1: SUPPLY AND INSTALLATION OF UPPER AIR STATIONS

Description: Includes site preparation, equipment and shelter purchase and installation, initial checkout, and operator instruction.

Task assumptions: No more than one site per city considered

Basic approach options:

Equipment options: (for vertical mixing definition)

A. 100-foot crank-up tower with 3 bi-vanes

B. 40-foot crank-up tower with 2 bi-vanes and minisonde program

C. 40-foot tower and bi-vanes only

Installation options:

State purchase, install with state manpower

Contractor purchase and installation package

Design basis for costing:

Unit costs and equipment summary are tabulated in attached tables

Manpower costs estimated at 2 man-weeks/site for installation

For contractor purchase option, cost estimated at equipment cost plus 15 percent and $1000/man-weeks

For state purchase option, cost is straight equipment cost, with manpower assumed in Task C5

Cost estimates:

Equipment option	No. of sites*	State	Contractor
A	4	$89,200	$104,600
	3	$72,400	$ 85,300
B	4	$72,400	$ 85,300
	3	$59,800	$ 70,800
C	4	$51,600	$ 61,300
	3	$44,200	$ 52,800

* 3-site option excludes Kalispell

TASK C1: UNIT EQUIPMENT COSTS FOR UPPER AIR OPTIONS

Option A

100-foot crank-up tower (Weathermeasure CM100)	$ 9,500
Additional third bi-vane	1,100
	$10,600

Option B

40-foot crank-up tower (Weathermeasure CM40)	$ 1,200
Minisonde receiver (½)*	2,000
100 minisondes and balloons	3,200
	$ 6,400

Option C

40-foot crank-up tower	$ 1,200

*Note: Assumed two receivers shared among four sites; the primary purpose is to "calibrate" the acoustic radar.

TASK C1: EQUIPMENT COSTS UPPER AIR STATIONS

	Anaconda	Billings	City* Missoula	Kalispell
Standard Equipment (RH, precip, pressure, photometer, temperature)	$ 4,000	$ 4,000	$ 4,000	$ 4,000
Two bi-vanes with anemometers	$ 2,200	$ 2,200	$ 2,200	$ 2,200
Acoustic radar installation	$11,000	$11,000	Existing	Existing
Vertical Mixing				
Option A (100' tower)	$10,600	$10,600	$10,600	$10,600
Option B	$ 6,400	$ 6,400	$ 6,400	$ 6,400
Option C	$ 1,200	$ 1,200	$ 1,200	$ 1,200
Total - A	$27,800	$27,800	$16,800	$16,800
- B	$23,600	$23,600	$12,600	$12,600
- C	$18,400	$18,400	$ 7,400	$ 7,400

*Note: Existing MHD site considered adequate for Butte

TASK C2: SUPPLY AND INSTALLATION OF SECONDARY WIND SITES

Description: Includes equipment purchase, installation, initial checkout, and operator instruction

Basic approach options:

Installation options:

State purchase, install with state manpower

Contractor purchase and installation package

Quantitative options:

- Three levels of network extent, as similar to Task B2, are essentially minimal (total 3 sites), extensive (12 sites), and an intermediate level (8 sites)

Design basis for costing:

Equipment:

Wind speed/direction sensors with clock-driven recorder (e.g., Science Associates 441)	$2,265
Average site costs; assume 1/5 ground at $1,000, 4/5 roof-top at $200	$ 360

For state purchase option, costed at equipment cost, with AQB manpower estimates

For contractor purchase, costed at equipment cost plus 15 percent, with manpower at $1000/man-week

Manpower estimated at 1/2, 1, 1-1/2 man-weeks for low, medium, high options respectively

Cost estimates:

	Cost estimate	
Network option	State*	Contractor
Low (3)	$ 7,900	$ 9,600
Medium (8)	$21,000	$25,200
High (12)	$31,500	$37,700

*Plus 1/2 to 1-1/2 man-weeks from AQB

TASK C3: SUPPLY AND INSTALLATION OF DATA LOGGING SYSTEM FOR UPPER AIR SITES

Description: Provide system for converting or transferring data from field site to computer-readable form in Helena, on a routine basis

Basic approach options:

- Five major technical options, as with AQ logging, as follows:

  A. Manually read charts, code forms, and punch cards

  B. Automated digitizing - charts to cards

  C. On-site recording with manual delivery of stored data

  D. On-site recording with telephone dumping of stored data once daily

  E. On-site microprocessor, no on-site storage, routine transmission to computer

     (1) dedicated WATS lines to WT computer in Bozeman

     (2) same as (1), cost shared with DNR

     (3) dedicated WATS lines to new DHES computer

  Note: Options C, D, and E permit incoming interrogation in conjunction with Task F5; D and E at no additional cost, C at additional cost of $450/site

Quantitative options: Only significant flexibility involves whether to locate sites (except for acoustic radar) at one of major AQ sites to save on data logging costs

Design basis for costing: See attached sheet for unit costs under various technical options

Required labor (either routine or repair) on options C, D, and E which should be similar for all three, is included with the field operation tasks.

Cost estimates:

Option	Cost (2 years)
A	$ 60,500
B	$ 73,000
C	$ 20,400
D	$ 22,300
E1	$ 97,900
E2	$ 54,700
E3	$118,100

TASK C3: UNIT COST SUMMARY

	One major met site alone		One major met site shared with AQ site[a]		Total for three shared sites plus two separate sites	
	2 yr	5 yr	2 yr	5 yr	2 yr	5 yr
Per-site Costs						
A	$12,100	$30,200	$12,100	$30,200	$ 60,500	$151,000
B	14,600	36,500	14,600	36,500	73,000	182,500
C[b]	5,100	5,100	3,400	3,400	20,400	20,400
D	5,600	5,600	3,700	3,700	22,300	22,300
E1	24,500	53,100	16,300	35,400	97,900	212,400
E2	13,700	28,000	9,100	18,700	54,700	112,100
E3[c]	29,500	58,100	19,700	38,700	118,100	232,300
Per-year Costs						
A					$ 30,200	$ 30,200
B					36,500	36,500
C					10,200	4,100
D					11,200	4,500
E1					49,000	42,500
E2					27,400	22,400
E3					56,000	46,500

[a]Two-thirds of capital costs for met site alone

[b]Central cassette reader ($3500) charged to Task B7

[c]Including one-half computer; other half in Task B7

TASK C4: HANDLING AND REDUCTION OF DATA FROM SECONDARY WIND SITES

Description: Provide routine reduction of data from multi-site field studies in four study cities. Strip chart and filter changing and transportation included in field operations manpower; this task provides only for chart reduction.

Basic approach options: There are several technical options, as in AQ data logging:

A. Manually read charts, code forms, and punch cards

B. Automated digitizing - charts to cards

C. On-site recording with manual delivery of stored data

D. On-site recording with telephone dumping of stored data once daily

E. On-site microprocessor, no on-site storage, routine transmission to computer

Task assumptions:

- Options C, D and E above all require electronic logging hardware on-site, and so are reasonable only for sites where several sensors are located. Costs used below for Option C (the lowest of the three) are based on location of the 2 wind parameters at the same site as one of the SO_2 sensors.

Design basis for costing: (See Task B7 for details)

Option A: $605 per parameter-year

Option B: $730 per parameter-year

Option C: Capital cost $5140 per site
Savings of $1000 per site on recorder

Supplies assumed at $2000 total

Cost estimates: (Based on 2 years operation)

	Data handling operation		
Network option	A	B	C*
Minimal (3)	$ 7,300	$ 8,800	$ 8,300
Medium (8)	$19,400	$23,400	$22,100
Extensive (12)	$29,000	$35,000	$33,100

*Assuming 2/3 of cost of handling wind speed and direction plus SO_2

Note: Option C column does not increase with number of years, while others are all proportional

TASK C5: FIELD OPERATION OF METEOROLOGY EQUIPMENT IN STUDY CITIES

Description: Meteorologist to maintain field network and interpret acoustic radar data

Task assumptions:

- Assumes that met sites receive some routine support under Area B, supplemented by a meteorologist under this task

Basic approach options:

- Personnel employed by state or local agency
- Contractor - provided manpower and state equipment

Quantitative options: Relatively little flexibility; with labor shared with AQ sites, one person may suffice for all three areas. However, estimate of 1½ man-years plus support from Helena may be minimal.

Design basis for costing:

State/local employment:

$12,000/year including salary overhead

Contractor personnel:

$11,000/year plus 40 to 50 percent = $16,000/year

Office support provided from existing facilities in either case

Local travel at $200/week

Cost estimates:

	State	Contractor
Manpower (2 years)	$36,000	$48,000
Travel	$ 5,000	$ 5,000
	$41,000	$53,000

TASK C6: SUPPLY, INSTALLATION, AND OPERATION OF METEOROLOGY EQUIPMENT IN EXTRA CITY

Description: Provide for an extra city met equipment comparable to that provided in the study areas

Basic approach options:

- Three approach options as in Task C1
- Three network options as in Task C2

Cost estimates: (Roughly approximated from other tasks)

Upper air site	$18,000 - $28,000
Secondary wind sites	$ 2,000 - $12,000
Field meteorologist	$12,000
	$32,000 - $52,000

TASK AREA D

EMISSION INVENTORY

Task No.		
D1	Point source inventory improvement - MAPS cities	$ 9,000 - $ 12,000
D2	Point source inventory improvement - Kalispell, Great Falls	$ 5,000 - $ 7,000
D3	Point source inventory improvement - Balance of State	$ 6,000 - $ 7,000
D4	Area source inventory improvement - MAPS cities	$10,000
D5	Area source inventory improvement - Kalispell, Great Falls	$ 7,000
D6	EIS computer system modification	$12,000
D7	Ongoing system for inventory maintenance and improvement	$ 5,000
D8	Emission factors for noncriteria pollutants	$ 3,000
D9	Improved emission factors for small sources	$ 3,000 - $ 11,000
D10	Localized roadway emission factors	$ 3,000 - $ 30,000
D11	Historical emission summary	$ 5,000 - $ 40,000
D12	Management of stack sampling program	$ 3,000
D13	Special study of mine haul road	$30,000
D14	Real-time inventory support of pulmonary studies	$ 5,000
		$106,000 - $182,000

TASKS D1-D3: POINT SOURCE INVENTORY UPDATE AND IMPROVEMENT

Description: Update computer data base through review of existing records with files and personnel from AQB and local agencies, telephone contact with sources, and other information if appropriate. Optionally, obtain information required to support inventory improvement re non-criteria pollutants, particle size, and monthly variation patterns.

Basic approach options: Three potential levels of effort:

A. Review and update by conventional techniques

B. Expand and improve by including more detailed concerns such as seasonal variations

C. Significant improvements in emission estimates through emission factor research or source testing

Quantitative options: Three degrees of coverage:

Task D1 - Four cities in three MAPS areas

Task D2 - Kalispell and Great Falls areas

Task D3 - Balance of state

Task assumptions:

- Basic approach C excluded; emission factor development is provided in other tasks, and source testing is beyond scope of MAPS

Design basis for costing:

Existing inventory assumed essentially complete with respect to source identification.

Costing based on commercial contractor labor at $900/man-week.

Cost estimates:

	Option A Basic	Option B Monthly, etc.
D1 - Four major MAPS cities	$ 9,000	$12,000
D2 - Kalispell, Great Falls	$ 5,000	$ 7,000
D3 - Balance of state	$ 6,000	$ 7,000

TASK D4-5: AREA SOURCE INVENTORY UPDATE AND IMPROVEMENT

Description: After reviewing existing data with local agency and AQB staff, update and improve data base by using updated data sources, seeking and utilizing better or more detailed data sources, and incorporating monthly variation patterns in the emission-generating activities.

Basic approach options: Two potential levels of effort:

- Update and improve based on best available existing data and emission factors
- Make significant improvements in emission factors, or provide more localized factors

Quantitative options: Two degrees of coverage:

Task D4 - Four cities in three MAPS study areas

Task D5 - Extend to Kalispee and Great Falls

Task assumption:

- Second basic approach excluded, as emission factor development is provided for under different tasks

Design basis for costing:

Based on commercial contractor labor at $900/man-week

Cost estimates:

D4 - Four major MAPS cities	$10,000
D5 - Kalispell, Great Falls	$ 7,000

TASK D6: EIS COMPUTER SYSTEM MODIFICATION

Description: Modify existing computer programs to accommodate monthly variations and day-of-week schedules and to provide for sources less than 25 T/year and non-criteria pollutants, including particulates in various size categories.

Options: No major technical or quantitative options

Basis for costing: Contractor labor at $1000 per man-week

Cost Estimate: $12,000

Interrelationships: Coordination with several tasks in Task Area F - Data Systems Development

TASK D7: ON-GOING SYSTEM FOR INVENTORY MAINTENANCE AND IMPROVEMENT

Description: Develop and initiate on-going administrative and communication system designed to facilitate and assure the continued maintenance of the inventory in an up-to-date status and the development and incorporation of improvements in emission factors. The system should be devised in consultation with all relevant personnel within the AQB and local agencies and at the major sources. It should be kept as simple as possible, but should address all of the following potential difficulties with inventories:

- Incomplete incorporation of changes in point source production rates, raw materials, operating practices, etc.
- Difficulty in maintaining current data on which to base area source estimates
- Inadequate emission factors based on national data or on old and inadequate source testing or research efforts, especially for small sources that are large in aggregates and for area sources

Basis for costing: Assumed best performed by mixture of in-house and local staffing, cooperative assistance, and possibly outside consultants; perhaps appropriately coordinated by MAPS project officer and advisory committee.

Cost estimate: $5000, possibly absorbable into MAPS management function

TASK D8: EMISSION FACTORS FOR NON-CRITERIA POLLUTANTS

Description: Provide data base of emission factors for non-criteria pollutants, including particulates by size, that are required to implement those portions of the improved emission inventory.

Basic approach options:

- Conduct literature search and current-work inquiries, and base factors on best existing data
- Conduct some degree of source assessment, either stack sampling or laboratory analysis of emitted material collected for other purposes

Quantitative options: Little flexibility-literature search efforts not much proportional to number of pollutants of interest.

Task assumptions:

- Restrict to literature search, other than what information arises from other MAPS efforts

Basis for costing:

Literature search available at nominal cost

Presumed labor primarily from student groups

Estimated cost: $3,000

TASK D9: IMPROVED EMISSION FACTORS FOR SMALL SOURCES

Description: Development of better emission factors for small sources that are typically aggregated into area sources; e.g., residential fuel use, recreational fires, slash burning

Basic approach options:

A - Conduct literature search and current-work inquiries (latter more likely useful)

B - Plan and initiate on-going program of developing small investigations, one source category after another, possibly involving minor testing efforts

C - Conduct significant research effort designed to improve factors

Task assumptions:

- Last option excluded as beyond present MAPS scope

Cost estimates:

Current data investigation	$3,000
Plan on-going investigation program (with Task D-7)	
Conduct one investigation; e.g., domestic fireplaces	$8,000

TASK D10: LOCALIZED ROADWAY EMISSION FACTORS

Description: Develop particulate emission factors for paved and unpaved roads appropriate to Montana

Basic approach options:

A. Literature search, etc., adopting factors to Montana soil and moisture conditions

B. Estimate air quality impact of roadways based on monitoring studies; substantially easier than trying to use monitoring data to estimate emission factors

C. Conduct field measurement studies to provide data for emission factor development

Design basis for costing:

Field studies envisioned in Option C range $15,000 - $25,000 per site, depending on complexity of site

Air quality impact (Option B) can be determined from $10,000 or less array of samplers; assume 3 sites and maximum integration with MAPS network

Literature search available at nominal cost, with labor presumed from student groups.

Cost estimates:

Option A:	$ 3,000
B:	$15,000 - $20,000
C:	$30,000 and up

Interrelationships: Should be planned in conjunction with general monitoring configuration (Task Area B) and in particular with Task B12, special studies using continuous particulate monitoring

TASK D11: HISTORICAL EMISSION SUMMARY

Description: Quantify roughly the likely emission levels over a period of 50 to 80 years, based on process knowledge and historical data on fuel patterns, major source location, process and technology changes, etc. derived from plant records, newspaper archives, and other historical sources. Such a study is an extension of the present "state-of-the-art", and hence must be considered a pilot effort.

Approach options: Begin with feasibility effort to identify and assess data sources before proceeding further.

Quantitative options: Pursue one or more of study cities

Design basis for costing:

Assumed pursued with student and other local effort, with some consultant or contractor assistance in process engineering if required.

Cost estimates:

Only pilot effort in Butte	$ 5,000
Major effort in Butte	$15,000
Major efforts in Billings and Missoula	$25,000

TASK D12: MANAGEMENT OF STACK SAMPLING PROGRAM

Description: Develop and oversee a program of source-supported emissions measurements on point sources with inadequate data.

Task assumptions: Should be done with in-house AQB manpower.

Cost estimates: $3,000

TASK D13: SPECIAL STUDY OF MINE HAUL ROAD

Description: Special field measurement program designed to assess impact of mine haul road on ambient TSP levels.

Basis for costing: Rough analogy with similar field programs.

Cost estimate: $30,000

TASK D14: REAL-TIME INVENTORY SUPPORT OF PULMONARY STUDIES

Description: Develop and implement an on-going program of documenting operating parameters and other variables affecting emissions during pulmonary function testing periods.

Basis for costing: Rough estimate of manpower requirements.

Cost estimate: $5,000

TASK AREA E

STATISTICAL ANALYSIS

Task No.	Title	Range of Estimated Costs
E1	Statistical Analysis of Morbidity Data	$ 4,000
E2	Initial Statistical Design for Pulmonary Function Studies	$ 2,000
E3	Preliminary Analysis of First Year COPD Patient Data	$ 6,000 - $10,000
E4	Preliminary Analysis of First Year School Children Data	$ 5,000 - $ 8,000
E5	Revision of Design for Second Year Operations	$ 3,000
E6	Summary Analysis of COPD Patient Data	$15,000 - $20,000
E7	Summary Analysis of School Children Data	$15,000 - $20,000
E8	Overall Analysis and Report Preparation	$10,000
		$60,000 - $77,000

TASK AREA F

DATA SYSTEMS DEVELOPMENT

Task No.	Title	Estimated Cost Range
F1.	Development of Standards and Effects Data Subsystem	$ 8,000 - $ 30,000
F2.	Development of Comprehensive Information System	$ 3,000 - $ 20,000
F3.	Design and Development of Air Resources Modeling System	$ 4,000 - $ 54,000
F4.	Entry of Existing Data into Air Resource Data Bank	$ 3,000 - $ 6,000
F5.	Provision of User Access to Air Resource Data Bank	$ 4,000 - $ 11,000
F6.	Develop Standards Data Base for Standards and Effects Subsystem	$ 0 - $ 10,000
F7.	Expand and Calibrate AQB Box Model, and Acquire Topographic Data	$ 3,000 - $ 7,000
		$25,000 - $138,000

Assumptions Relating to All of Task Area F:

- Computer system implemented on existing state system in Helena
  - proximity important
  - appropriate for long-term continuity
  - no major advantage to AQB in any other system (existence of time-sharing (TSO) on system at MSU, for example, is largely counterbalanced by the distance and cost)

TASK F1: DEVELOPMENT OF STANDARDS AND EFFECTS SUBSYSTEM

Description: Includes conceptual design, program writing and installation, user training, and necessary liaison.

Basic Approach Options: There are several hierarchical options, listed in order of increasing magnitude or complexity:

(1) Manual system (or no system)

(2) Simple storage/retrieval system for effects data from MAPS pulmonary function studies

(3) Option (2) plus provision for storing other MAPS-generated effects data, and design compatible with Comprehensive Information System

(4) Option (3) plus provision of standards data base structure (data base separate - F6)

(5) Option (4) plus added provision of standards vs. effects comparison/ analysis programs

Quantitative Options: No major quantitative flexibility exists, except in option (5), where the number of distinct analysis programs envisioned could vary from 1 to perhaps 4 or 5.

Task Assumptions:

- Option (1) eliminated because non-computerized data processing would almost surely be more expensive than a simple computerized system, and would have no lasting value
- Option (3) essentially eliminated because there would be no significant cost reduction compared to choosing Option (4)

Design Basis for Costing: Assumed task let to commercial contractor at $1000/ man-week.

Cost Estimates:

Option (2)	$ 8,000
Option (4)	$15,000
Option (5)	$20,000 - $30,000

Interactions: Desirability and timing of pursuing Option (5) are related to Task F6

TASK F2: DEVELOPMENT OF COMPREHENSIVE INFORMATION SYSTEM

Description: Includes participation in concept development, plus all program writing and installation, and user training.

Basic Approach Options: There are several hierarchical options listed in order of increasing magnitude or complexity:

(1) No computerized system, but rather have each independent subsystem function alone

(2) As (1), but develop list of desired interactions among subsystems and a written instruction booklet on how to accomplish them using the independent subsystems

(3) Basic design of computerized system, including one or two of the simplest of the desired outputs (e.g., an inventory search to locate specific matching data, which would be used by ARMS)

(4) Extension of Option (3) to incorporate all the identified output needs

Quantitative Options: No major quantitative flexibility except for the range of desired outputs in Option (4).

Task Assumptions:

- Option (1) essentially eliminated; Option (2) is a very minimal-cost way to initiate some effort, and it would have the intangible advantage of helping the users and systems analyst to define the requirements for the various subsystems

Design Basis for Costing: Assumed task let to commercial contractor at $1000/man-week, except that if Option (2) pursued alone, cost should be absorbed into management.

Cost Estimates:

Option	Cost
(2) alone	5 man-weeks internal AQB
(2) as start	$3000 plus 2 man-weeks AQB
(3)	$10,000
(4)	$15,000 - $20,000

TASK F3: DESIGN AND DEVELOPMENT OF AIR RESOURCES MODELING SYSTEM

Description: Includes review of modeling field, conceptual design of model-selection system, systems design of computer control system, programming and installation of system, and user training.

Basic Approach Options: Several hierarchical options, listed in order of increasing magnitude and complexity:

(1) No computerized system, but rather continue to choose and apply individual models as at present

(2) As (1), but codify in written form the data requirements and outputs of various component models, etc.; e.g., develop the decision framework on which system is based, but do not computerize

(3) Develop program to accept request for modeling required (pollutant, location, etc.), interrogate logical structure from (2) to determine model choice, interrogate data bank inventory for existence of appropriate data, and report back; however, not automatically run model

(4) Option (3) plus capacity to automatically retrieve the relevant data, and then call and run the relevant simple model (e.g., box model, Hanna-Gifford area source type, or roll-back model). This would function as a screening model system, but would be limited by the extent and quality of the area source data state-wide

(5) Option (4) plus the additional capability to extend the range beyond regions of good emissions data by means of a generalized land-use and topography data base (i.e., data at the section and/or census tract level)

(6) Extension of Option (5) to the point where the system will support the automatic running of the more elaborate major models as well as the simpler screening models

Quantitative Options: No significant flexibility except for the potential of developing new models under Option (4)

Task Assumptions:

- Assume no major model development efforts to be undertaken under MAPS; made on the basis of high cost and the fact that MAPS data is required to support model development

Design Basis for Costing: Assumed task is given to commercial contractor(s) at $1000/man-week

Cost Estimates:

Option	Cost
(1)	0
(2)	$ 4,000
(3)	$ 3,000
(4)	$12,000
(5)	$20,000
(6)	$15,000

TASK F4: ENTRY OF EXISTING DATA INTO AIR RESOURCE DATA BANK

Description: Coding, transcribing, etc., of existing data into input format for data bank entry.

Basic Approach Options: Little choice except option of putting all data in immediately or putting in selected portions as required. Staffing options of in-house keypuncher vs. commercial service.

Task Assumptions:

- Existing computerized air quality data to be entered with no significant cost
- Meteorological and other, special, data to be punched; assume half also need to be coded before punching

Design Basis for Costing:

Unit cost $0.06 per 5-parameter SAROAD card, for keypunch and verify; assumes experienced operator

Coding cost at 50 lines per hour, or $0.10 per card

Assume 6 major field studies for equivalent of 80 parameter-years of hourly data

Cost Estimate:

40 x 730 = 29,200 cards at $0.10 = $2,920 coding
80 x 730 = 58,400 cards at $0.06 = $3,504 punching

Total: $6,424

Partial option - assume half of data entered - $3,000

TASK F5: PROVISION OF USER ACCESS TO DATA BANK

Description: Provide convenient user access to data in Air Resource Data Bank.

Basic Approach Options:

(1) Conventional batch retrieval

(2) Remote computer terminal access

(3) Computer to computer communication

(4) Real-time access to data at sensors via incoming telephone interrogation capability

Quantitative Options: With Option (4), flexibility in number of sites outfitted

Assumptions:

- Option (2) pre-empted because current state computer system does not support TSO, the IBM time-sharing capability; however, option should be maintained for future
- Option (3) eliminated because it would be costly (> $10,000), and there appears no serious justification for it, or interest in it on the part of potential remote users, e.g., at MSU facility in Missoula. Such users are adequately served by Option (1) at no significant cost for sizable data needs and by (4) for any real-time uses
- At least minimal capability with Option (4) is desirable; DEC writer terminal suggested over teletype to permit subsequent use of line printer in conjunction with IBM 370

Design Basis for Costing:

Option (1) Less than $1000 in tape copy runs

Option (4) Dependent on data logging option chosen in Task B7. For logging Options A and B, the incoming interrogation capacity requires an entire microprocessor capability at $3,435 per site

For logging Option C, incoming interrogation requires an answering modem and command decoder at $450 in addition to existing equipment

For logging Options D and E, no additional equipment is required

DEC writer terminal for DHES office - $2,500

Cost Estimates:

4 major AQ/met sites with logging Option C	$1,800
2 additional selected AQ sites	$6,870

(Other quantitative options possible)

TASK F6: DEVELOP STANDARDS DATA BASE FOR STANDARDS AND EFFECTS SUBSYSTEM

Descriptions: Develop tabulation of air quality standards, and levels at which various effects occur, to enter into Standards and Effects subsystem. Includes the development of the data and its entry into system; the design of the tabulation format is included in Task F1, and the provision of programs to augment the tabulation based on MAPS-generated data is included in Task F2.

Basic Approach Options: There is initially only the option of conducting a literature search, with possible magnitude ranging from trivial to extensive; after at least one year of MAPS effects data is available, the initiation of a locally-based effects summary is possible.

(1) Minimal start using federal and state standards and episode criteria values

(2) Literature search for ten pollutants of primary concern (TSP, SO_2, sulfate, heavy metals); requires the definition of an effects classification scheme

(3) Thorough computerized literature search for all effects of all substances identified as air pollutants (exclude materials more commonly seen as toxic chemicals - pesticides, additives, etc.; preparation of extensive tabulation based on SAROAD parameter codes for computer entry

(4) Definition of (probably separate) tabulation based on MAPS results; programming to provide information is included in Option (5) of Task F1; note that (3) above is not necessarily required for (4)

Quantitative Options: The only quantitative flexibility concerns the number of contaminants considered; since computerized literature search capability is available at nominal cost, there is little significant choice

Task Assumptions:

- Both literature-derived and locally-based values will be designed into system
- All traditional air pollutants will be considered, with system design expandable in both number of pollutants and number of effects levels for each

Design Basis for Costing:

Extensive computerized literature search available at computer cost of << $1000; assume produces 1000 references

Manpower provided at in-house or local (University?) rates - $200-300/man-week; average review rate 4 references per hour

Cost Estimates:

(1) Essentially 0

(2) $3,000

(3) $10,000

(4) $3,000

TASK F7: EXPAND AND CALIBRATE AQB BOX MODEL, AND ACQUIRE TOPOGRAPHIC DATA

Description: Further develop and document the existing generalized box model, extending and adapting it for specific study cities; acquire required rough topographic data (i.e., box dimensions) from existing topo maps and field visits.

Note: This task definition results from the judgment that more extensive efforts to provide specific models for the study areas (i.e., terrain-modified dispersion models) are unwarranted until the extensive body of detailed MAPS meteorological data is gathered and assembled.

Basic Approach Options: No real flexibility, other than omission of the entire task; consideration can be given to using this as a vehicle for gaining some experience with computerizing topographic maps, but a box model is not a good or appropriate use for such detailed data.

Quantitative Options: There would be some savings in cost by not extending the model to cities other than Missoula, but not a major savings.

Design Basis for Costing:

10 man-weeks of local/AQB effort at $300/man-week

7 man-weeks of contractor labor at $1000/man-week (in conjunction with other systems development, and with AQB supervision)

Cost Estimate:

Local/AQB	$3000
Contractor	$7000